Metals Review

March 1957

Adolph E. Buehler
President, Buehler, Ltd.
(See Article, Page 4)

Metals Review
The News Digest Magazine

March 1957
Volume XXX, No. 3

Important Lectures

Departments

ASM Review of Metal Literature

Ray T. Bayless, Publishing Director

Betty A. Bryan, Editor

A. P. Ford, Sales Manager

G. H. Loughner, Production Manager

Marjorie R. Hyslop, Editor A.S.M. Review of Metal Literature

●

DISTRICT SALES MANAGERS

William J. Hilty
7301 Euclid Ave., Cleveland 3, Ohio
UTah 1-0200

John B. Verrier, Jr.
Fred Stanley
342 Madison Ave., Room 1228
New York 17, N. Y.
OXford 7-2667

Donald J. Walter
20050 Livernois St.
Detroit 21, Mich.
UNiversity 4-3861

Victor D. Spatafora
53 West Jackson Blvd.
Chicago 4, Ill.
WAbash 2-7822

●

Published monthly by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio: D. S. Clark, President; G. M. Young, Vice-President; C. H. Lorig, Treasurer; W. H. Eisenman, Secretary; G. E. Shubrooks, H. A. Wilhelm, G. A. Fisher and Carl E. Swartz, Trustees; A. O. Schaefer, Past President. Subscriptions $5.00 per year ($6.00 foreign). Single copies $1.00. Entered as Second Class Matter, July 26, 1930 at the Post Office at Cleveland, Ohio, under the Act of March 3, 1879.

Claims for missing numbers will not be allowed if received more than 60 days from date of issue.. No claims allowed from subscribers from overseas, or because of failure to notify the circulation department of a change of address or because copy is "missing from files".

Buehler's Gift to the "A.S.M. of Tomorrow" Makes History

A new era for the American Society for Metals was introduced a few weeks ago when the first financial contribution in the history of the Society was made by one of its loyal and long-time members.

Earmarked for the "A.S.M. of Tomorrow", this voluntary and unsolicited gift of $2000 was made by Adolph I. Buehler, president of Buehler, Ltd., Evanston, Ill. In making this outstanding contribution, Mr. Buehler wrote to W. H. Eisenman, secretary of A.S.M., as follows:

"Dear Bill: Upon receipt and studying 'The A.S.M. of Tomorrow' with the various plans for the erection and establishment of the various steps, I cannot help but to pour out my deep-felt congratulations of this courageous and most splendid idea of yours.

"To impress your friends and associates with the God-bestowed vision as to what is needed in our association and noble profession is your wonderful achievement, and will forever be remembered by the members of this Society.

"In my humble way, I would like to contribute towards this fine program. . . . It gives me great pleasure to enclose my check in the amount of $2000 as a contribution for this noble plan for 'The A.S.M. of Tomorrow' ".

In thanking Mr. Buehler for this gift, in behalf of the Society and the Board of Trustees, Mr. Eisenman wrote ". . . you really are making history, inasmuch as you are the No. 1 of the Society who has ever made a financial contribution to the development of the Society for any purpose whatever, and you are also No. 1 as the first contributor to the 'A.S.M. of Tomorrow'.

"I am confident that your unselfish action will be the opening gun for many contributors to the future of the Society's growth and services."

One of the nicest things ever said to me about the American Society for Metals was a statement made recently by Adolph I. Buehler, head of Buehler Ltd., Evanston, Ill.

"Well, Bill," he said, "I attribute the success of my business to the splendid achievements of your Society, its staff, officers and members, under your leadership. The A.S.M. has done a wonderful job in every respect. It has tremendously advanced the knowledge of metals—the development of new alloys and new techniques in fabrication and testing. My tribute, therefore, is without reservation; your Society is to me a shining light of accomplishment." All of us in A.S.M., of course, are happy and share in his enthusiasm for the work done by the Society.

A true devotion to his principles and convictions is one of the strong attributes of the man who made this statement. Although rarely seen in the circles of the American Society for Metals and its many chapters, his support is nonetheless genuine and impressive. His services in developing metallographic and metallurgical laboratory techniques have been invaluable in furthering the progress of science and technology in this field.

Buehler, His Background

Adolph I. Buehler was born on Nov. 1, 1893, in Brunnen, Switzerland, a quiet little village on Lake Lucerne, where his father ran a business as a watchmaker. In 1896 the Buehlers moved to Lucerne, the well-known tourist center, and founded there a watchmaker's and optician's establishment. Adolph attended public school and high school in Lucerne and, like all energetic youngsters, sometimes found it difficult to keep out of trouble. His boyhood recollections include daydreaming of faraway places. On the quiet shores of Lake Lucerne he would watch for the Orient Express speeding across the lake toward Paris, Vienna, Belgrade, Bagdad—or the St. Gotthard Express toward London, Paris, Milan, Rome, Naples. The rolling sound of the train was his magic carpet which would take him away to see and to live in foreign lands, so exquisitely portrayed in "Thousand and One Nights", or in the fabulous stories of Rome, Naples, and Pompeii of ancient time.

His father, a graduate from the School of Watchmakers in Solothurn, felt that son should follow father in the watchmaker's trade. He tried to give him an early start, to do away with his "dreamland", to learn the realities of life. But to sit quietly on a stool and work by hand on the tiny parts of a watch movement was not Adolph's choice, so he switched his apprenticeship to become an optician.

The optical trade to young Adolph seemed to offer much more latitude, with many unsolved mysteries to be uncovered. In the optical field belonged many instruments such as microscopes, theodolites, measuring instruments, and cameras. After the first part of a rigid apprenticeship, style 1911, the restless Adolph went to Lausanne's best optical establishment as a trainee. The schedule was: Work—8 a.m. to 6 p.m., one hour for lunch, (Saturdays until 5 p.m.); salary—none; obligations—a guarantee that the trainee would not for his lifetime accept a job by a competitive store in that city; a guarantee that the trainee would never engage in competitive business in that city; a guarantee that one full-year period must be completed. In the event of failure to comply with these conditions, Papa Buehler had to consent to a fine of 10,000 francs in gold.

The work, however, was interesting and instructive, and this practical experience inspired Adolph to go back to learning. The laws of optics and the improvement of scientific instruments were alluring fields to the young student.

In 1912 he entered the Optical College in Berlin, Germany, where his studies in optics and optometry were augmented by instructive visits to industrial plants such as Busch, Carl Zeiss, and the Glass Works of Schott & Genossen. On graduation, he returned to his father's business in Lucerne, Switzerland, and also worked with established opticians in Zurich and Basle. The first World War in 1914 prevented him from following a commitment to Sheffield, England, and he served with the Military until 1918.

Comes to United States

In the early 1920's his boyhood desire to travel and see the United States became irresistible and in 1922 immigration passage was granted him. The industry and opportunities in the United States made a profound impression on him and he decided that this nation would become his home. He lost no time to prepare himself for work in a new country by taking up studies at the Y.M.C.A. and Alexander Hamilton Institute.

In 1923, he joined E. Leitz, Inc., in New York as sales and service engineer for microscopes. In this capacity he traveled extensively and helped to introduce the famous Leica camera. He became interested in metallographs and other optical instruments—an interest that led to friendships with Francis F. Lucas of Bell Telephone Laboratories. Professors Waterhouse, Williams, and Homerberg of M.I.T., Dr. Krivobok of Carnegie Tech, Professor Stoughton of Lehigh University. Dr. Mahin of Notre Dame, and many more metallurgical celebrities.

On Dec. 12, 1927, he became a naturalized citizen of the United States. In 1929, E. Leitz, Inc., entrusted him to open a branch office in Chicago covering some of the Great Lakes states. The years of the depression did not deter him from specializing more closely in the industrial field, and he joined a laboratory supply house, Wilkens-Anderson Co. in Chicago, to establish an optical department.

Establishes Company

In 1936 he established his own business, dealing in optical instruments and metallographic sample preparation equipment. Persistence and hard work proved successful. From discussions with men in steel mills, foundries and universities, he learned of a great need for improved equipment for preparation of metallurgical specimens. The industrial field acted on him like a magnet, and in 1943 he found it necessary to establish an independent organization known as Buehler Ltd. to handle the sales of his products. The accelerated tempo of industry during the 1941-1945 period of high production taxed his limited facilities. However, he adopted a conservative outlook and planned a slow and thorough program of expansion.

Another challenge came in 1945. With the end of the emergency war period the need for improved apparatus became evident. Therefore, an independent experimental shop was established to develop new products and bring them to the production stage. The three organizations, under well-selected management, progressed rapidly. New equipment developed included a commercial electropolisher, an abrasive cut-off machine, and an improved specimen mounting press.

Directors of laboratories, purchasing agents, and metallurgists came to rely on Buehler's excellent method of cataloging his products, as listed in the 1939 issue of his publication, "The Metal Analyst". The new edition, released in 1952 and intended to last three years, was exhausted in less than a year.

In 1949 Buehler purchased a site in Evanston for the erection of a combined office and factory building so that all operations could be consolidated under one roof. This was a difficult undertaking. Despite the dire need for factory expansion to meet the increasing demand for Buehler products called for by industrial production increases, there were building restrictions to contend with, scarcity of building materials, and financing restrictions. But eventually, with sympathetic support from his friends and customers, the seemingly unsurmountable hurdles were met, and a dignified and imposing structure was completed early in 1954.

I have known Adolph Buehler for many years and his efforts to improve the tools of the metallographer have been tireless. His news publication, the *AB Metal Digest*, is respected and welcomed by metallographers everywhere.

In his dealings with his employees, he encourages perfection. They recognize him as a man of great integrity, yet generous and kindly. His door is always open to his employees, and many come to discuss their problems, assured of an intelligent, fair and unbiased opinion.

Mr. Buehler is a deeply religious man, as is evident in his relationships with others. He credits his success in both business and social matters to his firm belief in God and His guidance. From this, he humbly believes, comes his capacity for clear thinking, foresight, sound judgment, ingenuity, and ability to make positive decisions. His career is a tribute to the metallurgical profession.

"We all wish Adolph continued success".

W. H. Eisenman

W. H. Eisenman

Cites Advantages of the Cold Extrusion of Metals

Speaker: Ross W. Perry

Parker Rust Proof Co.

At a meeting of **Warren Chapter,** Ross W. Perry, manager, Cold Forming Division, Parker Rust Proof Co., presented a talk entitled "It Is Cheaper to Move Than to Remove Metal" which dealt with the process of cold extrusion of metals, its application to various types of parts and possible economies from its use.

In the past three years the use of cold extrusion in the production of parts has been expanded greatly; prior to this time its use had been limited almost solely to the production of ordnance parts.

Mr. Perry designated the various types of cold forming operations as follows: (1) coining; (2) backward extrusion; (3) forward extrusion; (4) drawing and ironing; and (5) upsetting. However, in true cold extrusion, all of the metal in the part is under compression.

Punch loads are held to 300,000 psi. Lubrication is very important with such high stresses and is accomplished with a Bonderite treatment (phosphate coating).

Advantages of cold extrusion are:

(1) Cheaper base materials can be used;

(2) Scrap savings realized because of the reduction in the amount of waste metal that has to be trimmed.

(3) Reduction or elimination of machining which results in lowered costs by savings on capital investment for machining equipment, eliminating purchase and maintenance of tools, and decreasing down-time for tool changes;

(4) Reduced labor costs;

(5) Higher production rates per dollar of invested capital;

(6) Improved surface finish;

(7) Closer tolerances; and

(8) Improved physical properties of extruded parts over machined parts. These operations were explained and illustrated with slides and sample parts.

With respect to the improvement in physical properties of cold extruded parts, Mr. Perry explained that because of the flow of the metal which takes place in cold extrusion, the physical properties of a part made from low carbon steel are often comparable to those of a part made by machining from alloy bar stock.

Parts which should be considered for production by cold extrusion methods are those parts which are of rather simple design and are required in great numbers.

Because of the cost of development of the tools, the more complex shapes have been limited to ordnance parts.

Mr. Perry was assisted by Messrs. Robert Harvey, William Dowsley, and Jack Haflinger, all of Parker Rust Proof Co., in a discussion period that followed the talk.—**Reported by J. O. Williams for Warren.**

Reviews PH Hardening Steels at Golden Gate

Speaker: Graham Hall

Armco Steel Corp.

In a talk before the **Golden Gate Chapter,** Graham Hall, Los Angeles district sales manager, Armco Steel Corp., reviewed the chemical, heat treating and physical characteristics of Armco "Precipitation Hardening Stainless Steels".

Mr. Hall reviewed the properties of Armco 17-7 PH as well as Armco 17-4 PH, two precipitation hardening stainless steels in widespread use in aircraft and allied industries. He also detailed a newer treatment for Armco 17-7 PH whereby Condition RH950 is attained with greater strength than possible with the Condition TH1050. The newer Condition RH950 is accomplished by holding a formed part at 1750° F. for 10 min., cooling to minus 100° F., and holding for 8 hr., followed by an age hardening treatment of 950° for 60 min.

Guarantees based on using the new RH950 treatment are 200,000 psi. minimum tensile strength and 180,000 psi. minimum 0.2% yield strength.

A newer alloy for yet higher temperature service than possible with 17-7 PH or 17-4 PH was described. Called Armco PH 15-7 Mo, this new alloy shows very great promise for use in the 800 to 1000° temperature range. —**Reported by E. R. Babylon for Golden Gate.**

Presents Nuclear Reactor Problems

Shown at a Meeting Held Recently by the Tulsa Chapter Are, From Left: G. R. Clay, Chairman; and W. D. Manly, Oak Ridge National Laboratory, Who Presented a Talk on "Materials Problems in Nuclear Reactors"

Speaker: W. D. Manly

Oak Ridge National Laboratory

Guest speaker at a recent meeting of the **Tulsa Chapter** was W. D. Manly, associate director of the metallurgy division, Oak Ridge National Laboratory.

Mr. Manly presented a well-illustrated and highly interesting talk on "Materials Problems in Nuclear Reactors", covering the general functions of the several common types of reactors and their present and possible future uses in industry. Of particular interest were the problems regulating to selection of materials for the various components of the reactors, corrosion problems pertinent thereto, and the design and construction of units. Mr. Manly was commended for his excellent treatment of his subject in spite of obvious need of careful consideration given to classified material. While only unrestricted material could be covered, many of the metallurgical problems yet to be overcome were brought to the attention of the group. **—Reported by A. N. Stevens for Tulsa Chapter.**

Describes High-Temperature Alloys

Speaker: E. E. Underwood

Battelle Memorial Institute

In a lecture entitled "A New Approach to High-Temperature Alloys", Ervin E. Underwood of Battelle Memorial Institute presented to the **Long Island Chapter** the latest developments in research which will help metallurgists to predict strength properties of proposed alloys for service at various temperatures.

Dr. Underwood pointed out that there has long been recognized a correlation between tensile strength and hardness for the prediction of room temperature strength properties. However, in the quest for such a correlation for high-temperature creep properties, investigators have been stymied. Dr. Underwood reviewed a number of attempts to find the causes of strength at high temperatures. Such factors as particle strengthening, softening temperature, grain size, valence and lattice strain were considered. In aluminum alloys and single crystals it was shown that a combined function of lattice parameter and valence changes could correlate either the hot hardness or the tensile flow stresses observed. Previously, for iron-base alloys, these correlations could not be obtained because of the uncertainty of the valence of the transition elements. However, by the use of Paulings' valences, correlations have now been obtained in binary and ternary alloys with a nickel and iron base.

Work by various investigators with high-temperature iron alloys revealed that correlations exist between the hot hardness and such properties as stress-rupture and hot tensile strength. Larson and Miller indicated the importance of the time of test and formulated a reliable correlation by plotting creep strength versus a function of time and temperature.

Dr. Underwood pointed out that, even though these correlations are very useful, the time involved in obtaining creep data is very long and, as a result, metallurgists have been seeking short-time tests to help in their predictions. Recent work at Battelle has shown that a practical method does exist which will facilitate such predictions. Using iron-20% chromium-base alloys with various ternary solute elements, it was found that hot hardness can be correlated with time to rupture and tensile strength by plotting versus a time-temperature function. A straight line results and within the validity of the correlation, a hot hardness test will give a close estimate of the creep or tensile strength. Other reported strength and hardness values are being reviewed to extend this strength-hardness correlation to more complex alloys. However, information in the literature has been of little help because data including hot hardness are rarely given.

Prior to the talk by Dr. Underwood, a 25-year membership certificate was presented to Hans Rose of Fairchild Engine and Airplane Corp. In addition, Herbert Kalish, Sylvania Electric Products, Inc., received the first past-chairman's certificate presented by the chapter. Mr. Kalish also was technical chairman for this meeting.**—Reported by R. H. Witt for Long Island.**

Wilmington Chapter Holds Charter Night Meeting

Speaker: A. O. Schaefer

A.S.M. Past President

The **Wilmington Chapter,** during its Charter Night meeting, heard special guests for the evening, including A. O. Schaefer, past national president A.S.M., W. J. Kinderman, president of the Philadelphia Chapter and Ralph Leiter, committee chairman for chapter promotion of the Philadelphia Chapter. Since the Philadelphia Chapter had provided invaluable assistance in forming the Wilmington Chapter, it was especially appropriate that the Charter was presented by Mr. Schaefer, a past chairman of Philadelphia as well as past national president. The ceremonies included the installation of chapter officers, including W. E. Lusby, chairman, J. E. McNutt, vice-chairman, W. E. Ellis, secretary, and H. B. Hix, treasurer. All of the officers are with E. I. du Pont de Nemours & Co.

The evening's activities at the DuPont Country Club included a social period sponsored by the Colorado Fuel & Iron Corp. After dinner and the formal business portion of the meeting, Mr. Schaefer spoke on "Forged Pressure Vessels". His talk included interesting information on the design and sizes of such vessels as well as methods of producing them. One of the most interesting parts of Mr. Schaefer's talk was concerned with brittle fractures of steel equipment. He reviewed many service failures of this nature as well as the research which has been and is being done to solve this problem. In addition, Mr. Schaefer outlined the additional research which should be undertaken to solve the problem of brittle behavior in steels. **—Reported by N. E. Whitcomb for Wilmington Chapter.**

Presents Aspects Of High-Frequency Heating at Columbus

Speaker: Joseph F. Libsch
Lehigh University

Joseph F. Libsch, professor of metallurgy, Lehigh University, spoke on the "Metallurgical Aspects of High-Frequency Heating" at a meeting of **Columbus Chapter.**

During the past six or seven years experiments designed to study the metallurgical aspects of induction heating have been conducted at Lehigh University. The response of different materials to hardening and tempering, as well as the influence of various alloying elements, have been studied and interpreted in terms of the short heating times involved.

Basically, any material which is an electrical conductor can be induction heated. Both the power available and the frequency of the alternating current are important in induction heating. In surface hardening minimum case depths are produced using high frequencies and high-power density.

The principle types of equipment used are motor-generator units, spark gap converters and tube generators. Motor generator units operate at frequencies of 1 to 10° K. c.p.s. and are available with high power ratings while tube generators normally operate at high frequencies (i.e., 400 to 500° K. c.p.s.).

Successful induction heating depends significantly upon coil design and suitable impedance matching. Typical work coils were shown and included simple solenoid, internal bore type, pancake or pie wound, split-type solenoid, transformer type, and a coil for brazing carbide tips. Variations in shape, based on the fundamental designs, allow heating of complex parts.

Induction heating can be set up in the production line by utilizing fixtures of various types. Included are fixed, rotating and progressive setups. Control accessories used are (a) quench rings (b) automatic timers and (c) specially adapted temperature controls. Temperature control will become more important in the future.

Induction heating varies from furnace heating in two notable respects: (1) very rapid heating rates are used; and (2) holding time at temperature is very short. These conditions provide a minimum of time for metallurgical reactions. It is necessary to design hardening and tempering treatments, and to interpret the results of induction heating, in terms of these short reaction times. Thus prior microstructure and the presence of alloying elements that form carbides may play an important role. Austenitic grain size, as well as degree of stress relief during tempering, are influenced by the short heating times.

While AISI 1045 and 1050 steels are most frequently used for induction hardening, alloy steels may be successfully hardened. Alloy steels consisting primarily of noncarbide forming elements behave the same as plain carbon steels. Steels containing carbide-forming elements (i.e., 4340, 4150, and 6150) must be heated to higher hardening temperatures to achieve similar degrees of carbide solution. Hardening temperatures 200 to 300° F. higher than those specified in furnace hardening have been used without excessive grain coarsening.

Quenched and tempered prior microstructures, providing a fine uniform dispersion of carbides, respond most readily in induction heating and allow attainment of minimum case depths. However, normalized and even hot rolled structures are suitable where minimum case depth is not required.

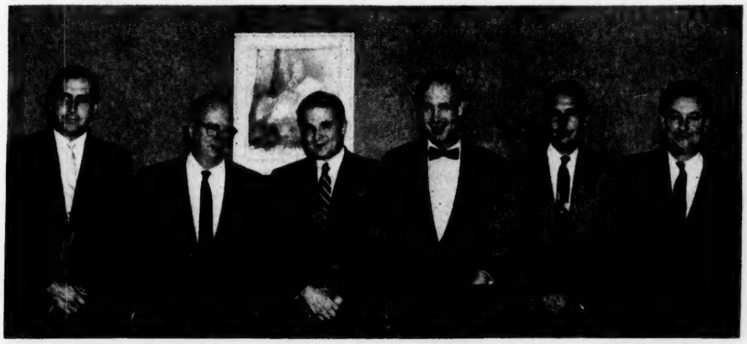
Parts hardened by induction may show superhardness; for example, higher hardness than the maximum expected in furnace hardening. One reason is that the induction hardened parts contain less retained austenite. Alloy steels hardened by induction may also show unusual microstructure such as the appearance of "pearlite-ghosts".

An interesting combination of mechanical properties may be produced in ductile iron castings by induction surface hardening. As an example, Dr. Libsch showed hardness-penetration curves for ductile iron having core properties of 89,000 psi. U.T.S., 69,000 yield strength and 12% elongation and a surface hardness of R_c 56-57. The prior microstructure and hardening temperature are very important in induction hardening ductile iron.

Today, several thousand tons of steel are successfully tempered each month by induction heating. Higher tempering temperatures compensate for the short heating times. For equivalent tempering cycles, the mechanical properties and the degree of stress relief are similar. On small pieces uniform results can be obtained with normal frequencies, while on larger parts 60-cycle induction heating shows promise.

Dr. Libsch exhibited a number of samples illustrating the use of induction heating for hardening, brazing and soldering. He also described some of the more recent applications of induction heating, including zone refining of germanium, silicon, etc., spectrographic analysis of molten metal samples, and hot machining.

San Diego Members Tour Convair



Members of the San Diego Chapter Recently Toured the Facilities of Convair San Diego Plant No. 2. Present at the meeting were, from left: Don Butterfield, U.S.A.F.; Al Higgins, works manager, Convair; George Cremer, vice-chairman; Larry Hull, chairman; Leif Nerheim, executive committee member; and John Gardner, superintendent of Convair's tool department

One of the **San Diego Chapter's** most successful and interesting dinner meetings was held in the dining room at Convair San Diego Plant No. 2 recently. After dinner, Al Higgins, Convair works manager, sometimes called "Mr. F102", welcomed A.S.M. members and guests. He gave a highly informative talk on Convair's supersonic all-weather fighter interceptor, the F102. The other guest speaker, Don Butterfield, chief acceptance pilot, U.S.A.F., Palmdale, told what it was like to fly the F102. The Delta wing design makes it one of the most stable rocket launching platforms he has ever flown.

A film, "The Invisible Line", which showed how optical tooling is used at Convair to build fixtures, was presented. The audience was then divided into groups of 25 and escorted through the home of the F102 by department supervisors. Each group was shown the large tooling departments and machine shop subassembly areas, where coordinated facilities speed the flow of parts and components to the stepped-up production assembly line of the F102A, Convair's supersonic all-weather fighter interceptor.—**Reported by F. A. Monahan for San Diego Chapter.**

Covers Fatigue and Life Testing

"Fatigue and Life Testing" Was the Subject Discussed by Francis G. Tatnall, Baldwin-Lima-Hamilton Corp., at a Meeting Held by Northwestern Pennsylvania Chapter. Shown during the meeting are, from left: George D. Kimpel, chairman; Otto Ehlers, secretary-treasurer; Mr. Tatnall; H. F. Bartell, technical chairman of the meeting; and J. G. Hoop, publicity

Flame Plating Technique Subject at Ottawa Valley

Speaker: John F. Pelton
Speedway Laboratories
Linde Air Products Co.

"Flame Plating", a method of applying a hard, dense, wear resistant coating to the surfaces of metals, was the subject of a talk given by John F. Pelton, assistant manager of development, Speedway Laboratories, Linde Air Products Co., at a recent meeting held by the **Ottawa Valley Chapter.**

After outlining the development of the techniques and equipment used to turn into constructive use the detonations obtained in gas mixtures containing acetylene, Mr. Pelton described the types of flame plated coatings, their properties, applications and limitations.

A specially designed gun is loaded with prescribed quantities of metallic powder, acetylene and oxygen. The powder remains suspended in the explosive gas mixture until a spark ignites the mixture producing heat and pressure waves which set up a detonation wave. When the detonation wave, which causes a rapid rise in pressure, leaves the barrel, the gases in the barrel rush out and the metallic particles which have become partially molten are hurled at high velocity at the piece to be plated. Although the gases reach a very high temperature the workpiece is not overheated because of the rapid dissipation of the heat waves as they leave the gun barrel.

Two powders are currently used commercially for flame plating, one a mixture of tungsten carbide and cobalt and the other aluminum oxide. While there is apparently no diffusion between the tungsten carbide coating and the base metal, indications are that the bond between the coating and the base is more than mechanical. The coating has an internal structural porosity of only 0.5% and has a hardness of about 1350 Vickers. The modulus of elasticity of flame plated tungsten carbide has been found to be between 28 and 35 million psi. as compared to 64 to 92 million psi. for sintered carbide. It is believed that the superior wear resistance of the flame plated coating is possibly due, in some cases, to the low modulus of elasticity.

The aluminum oxide coating has a porosity of about 1% but, for certain applications, it is advantageous to increase the porosity to 10%. With aluminum oxide a good bond is obtained on pure aluminum and titanium while a fair bond is obtained on glass. The bond obtained on steel, copper and brass is principally mechanical. The hardness of aluminum oxide coating is between 1000 and 1100 Vickers.

The flame plated coatings do not improve the corrosion resistance of the base metal and while they may slow down oxidation they do not prevent it.

Many flame-plated parts, such as mandrels, industrial knives, feed dogs and tubular drills, may be used in the as-plated condition. Other parts, such as gages, seals and forming dies, which require smooth wear surfaces, are ground using resin-bonded diamond grinding wheels.

Work is continuing on specific applications of the process and also on the development of new coatings which will have broad fields of application.—**Reported by P. J. Todkill for Ottawa Valley.**

A.S.M. spends $44.50 to service each member of the Society for a period of one year.

Describes Properties of High-Strength Steels at Canton-Massillon Meeting

Speaker: J. W. Sands
International Nickel Co., Inc.

J. W. Sands, constructional alloy steel section, International Nickel Co., Inc., spoke at a meeting of the **Canton-Massillon Chapter** on "High-Strength Alloy Steels".

Mr. Sands related his subject directly to the progress of the aircraft industry. During the second world war, AISI 4340, oil quenched and tempered at 900° F. for a 180,000 psi. tensile strength was considered the ultimate as regards the strength-toughness relationship. At present, landing gears, for example, are heat treated to the 270,000 psi. level and, because of heat treating and/or analysis modifications, a minimum sacrifice in toughness is realized. The weight-strength ratios of these ultra-high-strength steels are approaching those of heat treated titanium alloys.

Initially the major obstacle to increased tensile properties was the 500° F. temper embrittlement range. Thus, lowering the tempering temperature would increase tensile strength but markedly decrease impact strength. This effect was minimized by affecting the degree of embrittlement or by altering the embrittlement range itself. Republic Steel Corp., in association with Bendix Aviation Corp., developed a modified 4340 in which carbon was lowered, molybdenum increased and a small amount of vanadium added. As a result, impact performance was improved over standard 4340 at both the 230,000 and 250,000 psi. tensile strength levels.

The first ultra-high-strength steel, Hy-Tuf, employed the tempering resistance phenomenon imparted by a high silicon content. Ordinarily a 600° F. temper would result in minimum impact.

With the higher silicon (1.5 to 2.0%), however, a 600° F. temper results in maximum impact, with improved yield and ductility.

Another steel, HS-220, incorporates the beneficial effects of both the lower carbon and increased silicon contents. "Tricent" maintains the higher carbon analysis but incorporates analysis modifications including the high silicon content.

For evaluation of high-strength steels with respect to over-all ductility it has been established that notched tensile and transverse reduction in area values constitute the best criterion.

Future analyses will be developed to provide even higher tensile strengths with the maintenance of suitable toughness. As aircraft requirements go, so goes steel.—**Reported by J. E. Fogarty for Canton-Massillon Chapter.**

Cites Factors For Improving Production From Tools and Dies

Speaker: J. Y. Riedel
Bethlehem Steel Corp.

"Improving Production From Tools and Dies" was the subject of a talk given in **Minnesota** by J. Y. Riedel, Bethlehem Steel Corp.

Good tooling requires a combination of good tool design, sound toolsteel of the correct grade, proper heat treatment, good grinding practice and proper handling and use of the tools in service. To improve production from tools and dies it is necessary to determine which of these factors is the "weakest link" before a procedure for improvement can be planned.

Design factors which must be controlled to avoid failures of tools before they have worn out are sharp corners, re-entrant angles, extreme section changes, blind holes, keyways and compression overloads. Tapers are better than fillets on pneumatic tools. Prestressing to provide internal stresses opposite in direction to service stresses improves tool performance. Unloading notches decrease stress concentration and, generally, a series of notches is less damaging than a single notch. The use of air hardening toolsteel permits the designer much wider latitude than when toolsteels requiring liquid quenching are used.

Carburizing of SAE-type SI toolsteel produces tools which combine extreme wear-resisting surfaces with tough shock-resisting cores. Such tools outperform tools made of standard grades by conventional hardening procedure. Wear resisting steel, such as high-carbon high-chromium SAE-type D2, can also be improved by carburizing before hardening for some applications. Nitriding and cyaniding are also useful in improving the wear resistance of some types of tools. Short cycle hardening of high-carbon high-chromium toolsteels, involving a high-temperature quench plus a transformation temper, often provide increased wear resistance. Differential hardening of some tools improves tool performance. Many tools can be salvaged for further service by rehardening to regain worn dimensions or to produce a new chill on carbon steel water hardening tools.

The effect of stresses generated by grinding and methods of either using or avoiding these stresses were discussed. The direction of grinding scratches and removal of the "featheredge" from ground edges are also important. Maintaining proper clearances on tools is one of the most important operating factors. Control of the stroke to avoid unnecessary wear is important and proper feeding of stock must be maintained.

Slides were shown which presented production applications of the factors discussed. The speaker closed with a challenge that the performance of any tool can be improved if the expenditure of time, effort and money is warranted.—**Reported by H. F. Eilers for Minnesota.**

Describes Electronic Metallurgy at Quebec

Speaker: Pascal Levesque
Raytheon Mfg. Co.

At a recent meeting of the **Quebec Chapter**, Pascal Levesque, head of the metallurgical research laboratory, Raytheon Manufacturing Co., presented a talk entitled "Electronic Metallurgy".

In describing the unparalleled growth of the electronic industry during the last few years, Dr. Levesque tabbed the development of the transistor as one of the factors contributing to this growth. The essential part of the transistor is a tiny chip of a semiconductor material, usually silicon or germanium. From the point of view of their electrical properties, semiconductors occupy a position between conductors and insulators. To bring out these desirable electrical characteristics, it is necessary to reduce the impurity content of semiconductor materials to such concentrations that the addition of minute quantities of specific impurities will yield either electron or hole conductivity. The power gain due to transistor action was described and a comparison of the properties of both vacuum tubes and transistors was presented. Physical characteristics of semiconductors were explained in terms of carrier lifetime, energy gaps, etc.

Dr. Levesque explained the significance of the impurity segregation constants in the purification process of germanium and silicon. The purification of these materials is accomplished with the now conventional zone-melting technique. However, it is necessary in some cases to prevent possible contamination of the semiconductor material by the crucible. This is done by the floating zone technique, also described.

Single crystals of semiconductor materials are grown, usually, by slowly withdrawing a seed crystal from the melt (the Czochralski method). A modification of this method, used at Raytheon, was described and its efficiency compared to that of the conventional technique. The properties of the semiconductor material are greatly dependent on the technique of crystal growing. Dr. Levesque discussed these in terms of crystal imperfections which affect the recombination rate of holes and electrons.

In addition to germanium and silicon, some intermetallic compounds also exhibit semiconductor properties. In some instances, however, their preparation in single crystal form presents enormous difficulties. For example, indium phosphide has to be grown in a phosphorous atmosphere. The method of preparation and properties of numerous intermetallic semiconductors were also described.

Finally, the simple types of transistor devices, such as the point-contact, the grown junction, the jet-etched and the fused-diffused junction, were described.—**Reported by H. P. Tardif for Quebec.**

At Columbus National Officers Night

Clarence H. Lorig, National Treasurer A.S.M., Spoke at the National Officers Night and Ladies Night Meeting Held in Columbus. Dr. Lorig presented a complete picture of current and projected A.S.M. activities. Shown at the dinner preceding the talk are, from left: Mrs. O. E. Harder; Mrs. Lorig; Bruce Gonser; Mrs. D. C. Minton; Dr. Lorig; Mrs. Gonser; and D. C. Minton, vice-president, Battelle Memorial Institute

Uses of Atomic Power Topic in Peoria

D. A. Douglas, Oak Ridge National Laboratory, Was the Guest Speaker at a Meeting Held by the Peoria Chapter. Shown are, from left: L. A. Blanc, associate director of research, Caterpillar Tractor Co., technical chairman of the meeting; Mr. Douglas and A. L. LaMasters, chairman

Speaker: D. A. Douglas
Oak Ridge National Laboratory

At a meeting of **Peoria Chapter,** D. A. Douglas, manager of high mechanical properties group, metallurgy division, Oak Ridge National Laboratory, spoke on "Atomic Energy—Nuclear Powered Automobiles". Mr. Douglas also presented an animated cartoon-type film entitled "Atomic Energy at Work", which portrayed the basic concepts of atomic energy in layman's language very effectively.

When we realize the potential value of atomic energy, it becomes obvious why we are spending the vast amount of money to explore this field. For example, it has been estimated that world energy in the form of coal amounts to 40 billion tons. It is further estimated that there is an equivalent of 4000 billion tons of coal in economically reversible uranium. Engineers are constantly seeking better ways to control this vast quantity of energy all of which is well within man's power, and the future of our children is going to depend largely on developments in the atomic age.

Atomic energy has already found its place in the field of medicine. It is currently being used to locate tumors, diagnose heart ailments, and iodine isotopes are being used to treat thyroid conditions.

Mr. Douglas outlined the components of a nuclear reactor and listed potential materials for each together with attendant problems in application. As to potential application of atomic energy in transportation, whether it be by land, sea or air, the deciding factor must be the degree to which you can economically justify condensed fuel.—**Reported by J. I. Ragee for Peoria.**

Talk Deals With Relation Of Metallurgy to Corrosion

Speaker: F. L. Whitney, Jr.
Monsanto Chemical Co.

Frank L. Whitney, Jr., addressed the **Muncie Chapter** at a recent meeting on the subject, "Metallurgy in Respect to Corrosion".

Mr. Whitney, one of the pioneers in the investigation of many of the less understood aspects of corrosion, is manager of the corrosion section, engineering department, research and engineering division, Monsanto Chemical Co.

The speaker's talk dealt mainly with the causes and effects of internal corrosion. The importance of design and manufacture as factors in diminishing the problems associated with it was also thoroughly discussed.

Mr. Whitney illustrated his talk with a number of slides which showed the various factors concerned with internal corrosion, such as the spheroidization of pearlite adjacent to a welded area, graphitization, hydrogen attack, and many others.

While the whole field of corrosion is too extensive to cover fully in the limited time of one evening, the speaker did an excellent job of presenting many of its metallurgical aspects. Dealing directly, as it did, with one of the basic problems of the metals industry, the talk was both informative and thought provoking. —**Reported by R. R. Myers for Muncie Chapter.**

Describes Solidification Of Metals at Purdue

Speaker: W. S. Pellini
Naval Research Laboratory

W. S. Pellini, superintendent, Metallurgy Division, Naval Research Laboratory, gave a talk to the **Purdue Chapter** on "Solidification of Metals". The talk was well illustrated with slides depicting the various freezing conditions discussed.

The initial portion of the talk dealt with the technique for studying the solidification of metals and was followed by a discussion of some of the findings made during the basic investigation of metal solidification. A thorough coverage of the features of wall growth during solidification and the effects of mold material and thickness, as well as pouring temperature on solidification, was presented and illustrated.

Also included was some insight into how various metals react during the phenomenon of solidification. A clear picture of these differences was shown by cooling and temperature distribution curves.

In conclusion, the basic element for determining riser configuration and volume for various size castings, as well as the more common defects in castings, which are the result of the solidification pattern, were discussed. This portion also was quite clear because of the liberal use of slides.—**Reported by K. H. Schneck for Purdue Chapter.**

Effects of Induction Heating Given at Detroit

Speaker: H. B. Osborn, Jr.
Ohio Crankshaft Co.

Members of the **Detroit Chapter** heard Harry B. Osborn, Jr., technical director, Tocco Division, Ohio Crankshaft Co., speak on the "Latest Applications of Induction Heating and Effects on Mechanical and Physical Properties".

A concise and down-to-earth explanation of how induction hardening can produce desirable compressive stresses in excess of 200,000 psi. was presented. Dr. Osborn explained the advantages of obtaining increased fatigue life of highly stressed parts by this method.

He stated that induction hardening makes it possible to create compressive stresses in important high-alloy steel at cost savings. He illustrated the presence of compressive stresses by showing how the length of a pin increased after hardening. Tempering tends to level off the peak compressive stresses. Alloy steels tend to have longer gradients between the compressive stresses on the surface and the tensile stresses beneath the surface.

Many interesting slides of hardening, tempering, heating and welding applications were shown, both with ferrous and nonferrous materials. Examples of the use of all frequencies, from 60 cycle up, were presented.—**Reported by A. H. Smith for Detroit.**

Speaks on Clad Steel Plate at Oregon Meeting

Speaker: Louis K. Keay
Lukens Steel Co.

At a meeting of the **Oregon Chapter**, members and guests heard an interesting talk on the "Manufacture and Fabrication of Clad Steel Plate" presented by Louis K. Keay, Lukens Steel Co. Mr. Keay's talk was accompanied by slides, both in color and black and white, which emphasized salient points of the talk.

Mr. Keay outlined the history of the development of clad steel from its early beginnings to the important place it now occupies in specialty steel tonnage. He stated that the greatest tonnage made today is by hot rolling which effects a solid phase weld at the interface of the two sections.

His slides illustrated clearly the methods of packing the plates into sandwiches, with a refractory oxide used to prevent bonding, and nickel plating used to aid it where two clad plates are made simultaneously. The technique of seal welding the assembly was explained.

His talk included a discussion of the temperature requirements of the various metals and the dangers to be avoided in processing. Rolling and finishing after the sandwiches are prepared were covered, from soaking pit and rolling to descaling and final inspection.

Mr. Keay mentioned the various metals that can be made up by this manufacturing process.

A large part of the talk was devoted to the fabrication and possibilities of clad metals and the uses to which they can be put in the oil, chemical and paper industries. He explained the welding requirements, type of electrodes necessary and the finishing of the welds.—**Reported by C. G. Chisholm for Oregon.**

Some Future Trends in Extractive Metallurgy Outlined at Ontario

Speaker: L. M. Pidgeon
University of Toronto

Members of the **Ontario Chapter** heard L. M. Pidgeon, head of the department of metallurgical engineering, University of Toronto, speak on "Some Future Trends in Extractive Metallurgy" recently.

Dr. Pidgeon divided the metals under discussion into precious, commercial nonferrous and manufactured groups, further subdividing the last group into two divisions, one including iron and aluminum, and the second including magnesium, titanium and zirconium.

In the precious group, great importance is placed upon the prospector, with the metallurgist being relatively unimportant. The future of gold, the chief member of this group, does not appear to be too bright, due to the rising cost of labor, the fixed price of the metal and its small field of application.

The commercial nonferrous group, which includes copper, zinc and lead, is of greater interest to the extractive metallurgist, but the processes used have not essentially altered for a long time. The only metal in this group of interest, mainly due to its vast application, is nickel, and the speaker mentioned the research being conducted in this field, as well as research into refining, due to the necessity of using poorer grade ores.

Concerning the manufactured group, in the iron and aluminum division, only large companies can enter the field of processing because of the capital outlay required, although methods of extraction are not new. The role of the metallurgist, however, is all important in this group, both for the iron and aluminum as well as the magnesium, titanium and zirconium divisions.

Great research into the processing of these latter metals is being conducted and the results of this research may frequently be applied in other fields. New applications are constantly being found for these metals, which makes further research into their processing mandatory.

Dr. Pidgeon also covered the processing of uranium ore and the applications of the metal, with special reference to its potentialities in the future.—**Reported by V. G. Behal for Ontario Chapter.**

At Recent Meeting in Rhode Island

A Recent Meeting of the Rhode Island Chapter Included a Coffee Talk on "Geology, Glaciology and Metallurgy" by Richard Chorley of Brown University, and a Talk on "Titanium Today and Tomorrow" by Leo J. Barron, Applications Engineer, du Pont de Nemours & Co. Shown, from left, are: Sidney Siegel, chairman; R. J. Lombard, du Pont; Prof. Chorley; Mr. Barron; and Cliff Ey, Grinnell Corp., program chairman. (Report by M. C. Battey)

Worcester Hears Talk on Stainless

Leaders at a Recent Meeting Held by the Worcester Chapter Included, From Left: Walter J. Nartowt, Greenman Steel Treating Co., Technical Chairman; Russell G. Cameron, New England Metallurgical Corp., Who Spoke on "Modern Heat Treating and Brazing of Stainless Steel"; Roger Williams, Carlings Ale Co., Who Gave a Coffee Talk Describing Carlings' New Plant at Natick, Mass.; and Lincoln G. Shaw, Pratt & Inman, Chapter Chairman

Discusses Salt Baths at Louisville

E. N. Case, Sales Manager, Ajax Electric Co., Spoke on "Quality Control With Salt Bath Heat Treating" at a Meeting in Louisville. Present were, from left: Mr. Case; R. Thompson, chairman; and H. Keller

Speaker: E. N. Case
Ajax Electric Co.

E. N. Case, sales manager, Ajax Electric Co., gave a talk on "Quality Control With Salt Bath Heat Treating" at a meeting held by the **Louisville Chapter.**

Mr. Case discussed some of the economies of salt bath furnaces, including: (1) long life and reasonable maintenance; (2) high productive capacity per unit of floor space; (3) protection of surface of the work; (4) reduced distortion; (5) low investment per unit of production; and (6) elimination of skilled labor. The reasons for these advantages were explained.

Some of the disadvantages of salt baths were also mentioned. These were that parts usually must be washed due to residual salt left after quenching and there is a problem of disposal of salts in quench and the limitation of the salt since it has a definite working range.

It was explained that salt baths have inherent properties that have a beneficial effect on material being treated in them. When a cold part is immersed in a salt bath, a layer of frozen salt immediately envelopes the entire piece. This shell of frozen salt protects the part from thermal shock by acting as an insulator. This layer usually melts in a short time and the piece is then rapidly heated to the temperature of the bath.

Mr. Case briefly commented on various processes for which salt baths can be used, including neutral hardening, high speed steel tool hardening, cyaniding, carburizing, annealing, interrupted quenching, descaling and desanding, brazing, cleaning, depainting and de-enameling. Slides demonstrating the many applications of salt baths were also shown.—**Reported by C. C. Jenkins for Louisville.**

Members of Atlanta Chapter Tour Heat Treating Plant

Speaker: E. L. Smith
Southern Metal Treating Co.

Members of the **Atlanta Chapter** heard E. L. Smith, manager, Southern Metal Treating Co., of Georgia, talk on the heat treating operations performed in his plant.

Mr. Smith told of the numerous types of heat treatments that his installation is capable of performing and the varied types of materials and pieces that can be handled there. The plant has a number of modern commercial heat treating units covering all types of heat treating processes, such as tool and die hardening, annealing, normalizing, case hardening, liquid carburizing and many others.

The meeting included a plant tour and recognition of the company as a sustaining member. — **Reported by James Johnson for Atlanta.**

Tour Vacuum Machine Company

Members of the Rockford Chapter Were Guests of the Atwood Vacuum Machine Co. During a Recent Meeting. From left: John B. Thorsen, vice-president, and Seth B. Atwood, chairman of the board, explain some of the history of the company to D. A. Campbell, chapter chairman. (Soper Co. Photo)

The **Rockford Chapter** held its Home Industry Night meeting recently with 90 members and guests attending the dinner and tour of the Atwood Vacuum Machine Co.

Seth B. Atwood, chairman of the board, gave a brief history of the company, followed by John B. Thorsen, vice-president in charge of operations, who related some interesting facts about the company.

Atwood Vacuum Machine Co. was founded in 1909 when Seth Atwood and his brother undertook the building of vacuum cleaners for large buildings and hotels. In 1916, bothered by new cars with doors that rattled, they developed an adjustable door bumper. After the door bumper had received universal acceptance by the auto industry, the Atwoods developed door hinges and other auto hardware, and the company has continued to grow steadily.

In addition to the Rockford plant, Atwood Vacuum Machine Co. has plants in Stockton, Ill., Detroit, Mich., and a subsidiary in Canada.

Some of the auto parts which the A.S.M. group saw in process were door hinges, door locks, trunk hinges, hood hinges, trailer hitches, and push button controls for automatic drive units.—**Reported by J. F. Sisti for Rockford Chapter.**

Speaks on New Metal Sources

J. H. Carpenter, Carpco Manufacturing, Inc., Spoke on "The World's Sources of the New Metals" at a Meeting Held by Jacksonville Chapter. Shown are, from left: W. G. Simpson, J. M. Tull Metal & Supply Co.; L. K. Shave, Guest; Mr. Carpenter; and Chet Shira, chairman of the Chapter

Speaker: J. H. Carpenter
Carpco Manufacturing, Inc.

J. Hall Carpenter, president of Carpco Manufacturing, Inc., discussed "The World's Sources of the New Metals" at a meeting of the **Jacksonville Chapter.** The meeting was held at the new warehouse of J. M. Tull Metal and Supply Co.

Mr. Carpenter briefly told the story of the beginning and growth of Carpco Manufacturing Co. Highlight of his talk included the use of colored film taken during installations of Carpco equipment in all corners of the world. Carpco provides complete services in research and engineering, equipment manufacturing and plant construction, with particular interest in the ores of titanium, zirconium and columbium. The film showed the various processes involved in extracting and beneficiating the ores of these metals all around the world.—**Reported by George Black for Jacksonville.**

Terre Haute Filled in on Atomic Power Development

Speaker: C. E. Klotz
Atomic Power Development Assoc.

Members of the **Terre Haute Chapter** were guests of one of their sustaining members, Allis-Chalmers Manufacturing Co., for a meeting on "Nuclear Power Development". The speaker was C. E. Klotz, Atomic Power Development Association, Inc., a nonprofit membership corporation having as its primary objective the development of atomic power into a commercially practicable means of electric power generation.

Mr. Klotz described the design of a fast power breeder reactor plant. The reactor power plant includes a reactor, associated fuel-handling equipment, control devices, heat removal and steam generation equipment and electric power generating facilities. Most of the heat and part of the new fuel is produced in the reactor core. Surrounding the core is a breeder blanket where more new fuel is produced. Heat is removed from the reactor core and blanket by circulating a liquid metal sodium. It is transferred to a secondary exchanger and is then transferred to water and steam in the steam generator. The methods for loading and unloading the reactor were explained as were the various control methods to be utilized.

It was noted that the reactor has been conservatively designed and that safety has been emphasized even at the sacrifice of performance.—**Reported by G. R. Follis for Terre Haute Chapter.**

Points Out Reactions of Common Gases and Iron

Speaker: R. F. Novy
Lindberg Engineering Co.

A topic very broad in its various aspects was presented in an interesting manner by Russell F. Novy of the Lindberg Engineering Co. at a meeting of the **Dayton Chapter** in a talk on the "Reactions of Common Gases and Iron."

Several curves prepared from the practical, rather than the purely theoretical, viewpoint were presented, representing equilibrium between temperature, dew point and carbon potential. The conversion of CO to CO_2 between 1250 and 900°F. gave justification to the necessary quick cooling of these products.

Methods of gas sampling, with the errors possible, both obvious and not too obvious, were brought to focus by Mr. Novy. Atmosphere recovery time necessitated by normal use of a batch-type furnace brought to light exactly how long it takes a furnace to revert to acceptable gas composition after its door is opened for a given length of time.

Newer techniques of carburizing steels after fabrication rather than using higher carbon steels to start with were justified in many instances, especially when deep drawing was involved. Typical costs of generating necessary atmospheres for various work, including through carburizing and carbon restoration were outlined with actual savings over other processes pointed out. Gaseous versus liquid cyanide carbonitriding was also included.—**Reported by R. A. Grayson for Dayton.**

Wins Scholarship at Maryland

Edwin Ellsworth Maust, Jr., Received the 1956 A.S.M. Foundation Scholarship From Nat C. Fick, Washington Chairman, During the New Members and Students Night Meeting. Edwin, a student at the University of Maryland, plans to continue his study of metallurgy at the post-graduate level

Presents Talk on Vacuum Metallurgy

Peter C. Rossin, Manager of Pilot Plants, Universal Cyclops Steel Corp., Who Spoke on "Vacuum Metallurgy and Its Ramifications" at a Meeting of Chicago Chapter, Is Shown (Left), With Technical Chairman J. Stewart

Speaker: P. C. Rossin
Universal Cyclops Steel Corp.

Chicago Chapter members heard P. C. Rossin, manager of pilot plants, Universal Cyclops Steel Corp., discuss "Vacuum Metallurgy and Its Ramifications", at a meeting which was held recently.

In considering high-temperature metals and alloys, we are vitally concerned with vacuum processes for their melting and fabrication. The vacuum induction furnace and the consumable electrode or cold mold furnace are currently the most attractive melting processes. The former, as the name implies, involves an induction furnace with charging and pouring facilities in vacuum. Charge buckets are introduced through a vertical tube to the furnace chamber by means of a vacuum lock system. Pouring facilities include stools and molds for 500 to 2000-lb. ingots, the ingot size being determined by the alloy being cast. Furnace operation is guided by instrument. Nickel and cobalt-base alloys are currently being melted on a pilot scale. These alloys, which may contain titanium and aluminum as high as 3% each when produced by air melting practices, are unsatisfactory because of inclusion and fabrication problems. Recovery of alloy additions ranges from 90 to 100% in this vacuum process. There are pronounced effects obtained from small additions of elements such as boron and zirconium.

The alloys produced have improved stress rupture, fatigue and toughness properties. Good distribution of carbides is realized and inclusions are minimized.

In the consumable electrode process, a previously melted and cast to shape electrode, which is of the composition of the alloy being melted, is lowered and the arc struck between the electrode and a water-cooled copper mold. The pressure within the chamber has been reduced to less than one micron. The electrode is continuously melted and concurrently cooled in the copper mold. The melting rate within pilot units has been approximately 2 lb. per 1000 amp. per min. A stirring coil is used to stabilize the arc and promote ingot homogeneity. Ingots 16 in. in diameter have been produced with no cracks, and with cross-sections exhibiting minimum segregation and improved ingot structure, and have as low as 20 to 30 ppm. total gas content at the ingot center. The principal feature of the alloys so produced is the vastly improved cast structure. A pilot plant, containing three 2 to 7-ton furnaces, 75 x 200 ft., is under construction.

The most spectacular phase of Mr. Rossin's discussión was concerned with the vacuum fabrication of refractory metals and alloys at temperatures ranging from 2500 to 4000° F. in an inert atmosphere. A 40 x 90 x 22 ft. room is now being considered for molybdenum fabrication. The atmosphere would be argon, introduced by air displacement, or helium, introduced by filling and bursting a balloon within the room. Ingots of molybdenum are to be induction heated to 4000° F. and impact forged to 4 x 4 in. billets or 2 to 4 x 12 in. slabs. These products would then be reheated in graphite muffles and rolled to sheet. Total impurities within the atmosphere would amount to between 50 and 200 ppm.

Fabrication processes and materials handling will be automated, with man power required only for observation and trouble shooting in initial pilot studies. Because of the high cost of gas, this process is but a means to an end, vacuum processing being the future goal.

In closing, Mr. Rossin told of the problems involved in personnel entering and leaving the structure. Development of "space-suits", patterned after those for military pilot protection, systems for breathing, air conditioning and intercommunication, and the "waffle-iron" air lock entrance system are now in the advanced planning stages. — **Reported by E. C. Rudolphy for Chicago.**

Syracuse Members Given Heat Treating Hints

Speaker: D. R. Edgerton
Lindberg Steel Treating Co.

Syracuse Chapter members recently heard a talk on "Heat Treating Hints" presented by D. R. Edgerton of the Lindbergh Steel Treating Co.

Basic requirement in heat treating is to produce the best possible part at the lowest possible cost. To achieve this, active cooperation is needed between the steel producer, designer, metallurgist and all others concerned. The steel producer has done much in this respect with his improved steels, processes and controls.

In heat treating, because so much is at stake, it is wise to play safe. Mr. Edgerton presented basic rules which he feels are necessary for proper heat treating: (1) Choose the safest possible steel for the job; (2) make certain that the prior structure is suitable for hardening; (3) the design must have balance and symmetry and include generous fillets and radii; and (4) control machining and grinding processes and remove decarburization and excessive tool marks.

Slides were shown which illustrated the common faults and the difficulties experienced when these faults were present.

An interesting point was brought out in controlling growth. Mr. Edgerton found that a part which has been quenched will have a certain growth. If the part is then annealed and requenched a consistent growth factor is attained based on the original value.

Some other examples were presented where parts with a complex geometry were held to close tolerances. Controlled atmosphere heating and cooling are used for this application.—**Reported by G. F. Trojanowski for Syracuse.**

Speaks on Hardenability Control

B. R. Queneau, Chief Metallurgist, Duquesne Works, U.S. Steel Corp., Spoke on the "Hardenability Control of Low Alloy Steels" at a Meeting in Texas. Present were, from left: Joe B. Marx, secretary-treasurer; R. F. Goff, chairman; Dr. Queneau; and C. L. Horn, vice-chairman

Speaker: B. R. Queneau

U. S. Steel Corp.

B. R. Queneau, chief metallurgist, Duquesne Works, U. S. Steel Corp., discussed low alloy steels, with particular reference to control of hardenability, in a talk on "Hardenability Control of Low Alloy Steels" given before the **Texas Chapter.**

The growth of metallurgical control in the steel industry was covered briefly including the development and use of the Jominy end quench hardenability test. The interchangeability of alloying elements and the use of boron steels were covered, followed by a look into the future concerning the ability of the steel mills to meet closer hardenability controls.

Dr. Queneau mentioned that there are still a number of hardenability tests being used in industry. The Jominy test, however, seems to be the most generally accepted. Briefly, the Jominy hardenability test involves heating a 1-in. round bar 4 in. long to proper austenitizing temperature, placing it in a special fixture and quenching it with a spray on one end only. After this, two parallel flat faces are ground 0.015 in. deep on opposite sides, and the Rockwell hardness is checked at 1/16 in. intervals. In speaking of the Jominy test, it is necessary to differentiate between hardness and hardenability. Hardness is a function of the carbon content, while hardenability has to do with the slope of the curve when hardness is plotted versus the distance from the quenched end.

In 1943, an SAE-AISI committee set up limits for hardenability bands for a given analysis. These hardenability bands were the basis for our present H-steels. Through the judicious utilization and understanding of the H-bands, low alloy steels can often be substituted for each other without sacrificing properties or changing processing methods. As an example, AISI 43B17 might be substituted for the difficult to obtain and more highly alloyed AISI 3310. In further discussing the control of hardenability, it was mentioned that the mills now have better control by the use of rapid spectrographic analyses.

In conclusion, Dr. Queneau stated that closer control of hardenability in low alloy steels is primarily a problem in economics, both for the consumer and the producer. A possible answer: Cut down further on the number of grades of alloy steels. —**Reported by R. C. Anderson for Texas Chapter.**

Metallurgy of Jet Engine Given at York Meeting

Speaker: M. E. Cieslicka

General Electric Co.

At a meeting of **York Chapter,** M. E. Cieslicka, manager, materials engineering, jet engine department, General Electric Co., Evansdale, Ohio, presented a talk on the "Metallurgy of Jet Engines".

A brief history of powered flight was presented in which important milestones were highlighted. The general aspects of jet engine operation and design were given. The functions of the important components and the environment in which they operate were described.

The concepts associated with rupture of metals at eleveated temperatures were discussed in some detail. The relationships between temperature, time and stress were explained on the basis of the Larson-Miller parameter method and some limitations of the method were given. The statistical nature of rupture was discussed, with emphasis on quality control, test methods and consistency in manufacture. To present the properties of high-temperature materials in proper perspective, Mr. Cieslicka compared M-252, Adimet 500 and 321 stainless steels.

Another important criterion of design, modified Goodman diagrams or stress range diagrams, was discussed. The difficulty of obtaining such data indicated another reason for the need of extremes in quality control and consistency in manufacturing. — **Reported by Joseph L. Brown for York.**

Briefs Buffalo on High-Speed Heating

"The Economic and Metallurgical Aspects of High-Speed Heating" Were Explained by Charles A. Turner, Jr., at a Meeting of the Buffalo Chapter. Mr. Turner, chief metallurgist, Selas Corp. of America, discussed the role played by fast heating as developed by the combustion of air and gases in special ceramic burners where the temperature of the affluent gas mixture is approximately 3000°F. Shown are, from left: Charles Hart; Mr. Turner; and Mat Hayes, chairman. (Reported by G. F. Kappelt)

Discusses Fabrication of Aluminum

Charles J. Hinton, Aluminum Co. of America, Spoke on the "Fabrication of Aluminum" at a Meeting of the Boston Chapter. Shown are, from left: H. D. Stuck, chairman: Mr. Hinton; and M. J. Smith, technical chairman

Speaker: C. J. Hinton
Aluminum Co. of America

Charles J. Hinton, head, appliance section, sales development division, Aluminum Co. of America, gave a descriptive picture of the new aluminum alloys and products now making their appearance on the American market in a talk on the "Fabrication of Aluminum" before the **Boston Chapter.**

Cloth with colored aluminum thread is now possible for women's dresses and spangle sheet of controlled grain size, highlighted by acid etching, will soon make its sales appearance. Prefinished sheets, tube and extruded shapes can be furnished with Alumilite finishes, organic coatings, electroplated or porcelain enamel finishes.

Mr. Hinton pointed out that aluminum has the highest electrical conductivity of any metal, when considered pound for pound, has excellent reflectivity for light, high heat conductivity, is nontoxic, nonsparking and nonmagnetic. And, by addition of small quantities of other metallic elements, such as manganese, copper, magnesium, silicon and zinc, possibly followed by heat treatment, strong alloys can be obtained which have excellent mechanical properties for possible structural applications. He explained the compositions of the various grades, stating that each grade has specific properties which can be adapted for specific applications. The different temper grades were also explained.

Mr. Hinton stated that the Alumilite process increases corrosion resistance and is an integral part of the surface metal. The composition of the alloy affects the color of aluminum as well as uniformity of coating. Silicon and copper give a dark gray color. Boral is a new product of boron carbide and aluminum which is used as neutron shields and a ¼-in. thick plate is equivalent to 26 in. of concrete. Aluminum powder metallurgy products are produced from an aluminum powder compact, or forged to shapes which are sometimes further worked by rolling or drawing. They maintain their strengths at higher temperatures and for longer times than do heat treatable alloys. An unusual characteristic is a decrease in elongation with temperature. Aluminum oxide is now being bonded to aluminum sheet for abrasive tread plates. The oxides stand up well under abrasive action, whereas the conventional tread plate will wear to produce a flat slippery sheet. "Spangle" sheets are rolled and grain size is controlled. For decorative purposes, aluminum sheets are anodized and then dyed decorative colors.—**Reported by H. I. Dixon for Boston Chapter.**

Briefs Cedar Rapids on Aluminum Extrusion Method

Speaker: Jack Canady
Titus Metals Corp.

At a meeting of the **Cedar Rapids Chapter,** Jack Canady, general manager, Titus Metals Corp., presented a talk on the "Extrusion of Aluminum".

Mr. Canady described the products of the process and their unique properties and advantages. He then explained the machinery and tools used to extrude, straighten and further fabricate aluminum. The third phase of his talk covered the raw materials, the extrusion process itself, and post-treatments available, including heat treatment and various finishes.

The talk was illustrated with a wide selection of extruded samples, finish samples, and some dies and tools used in producing extrusions. An attractive motion picture was shown to further illustrate the principles and results of extruding.

Past chairmen of the Chapter were honored and past-chairmen's certificates were presented to Edward M. Midnik, 1954-55 chairman, and Ralph M. Triem, 1955-56 chairman. The coffee speaker, Leslie Grigg, director of adult education, Cedar Rapids Public School System, described the program of adult education as administered in the Cedar Rapids schools.—**Reported by Elmer M. Bruce for Cedar Rapids.**

Speaks on Control of Carbonitriding at Meeting in Syracuse

Speaker: J. B. Given
International Business Machines Corp.

Members of the **Syracuse Chapter** recently heard a talk on "Control of Carbonitriding" by J. B. Given, International Business Machines Corp.

Mr. Given explained in detail the experimental cycles performed to arrive at satisfactory properties and microstructures of thin cases for small wearing parts. Slides showing typical microstructures and properties encountered in the various cycles were also shown. The limitations of the process and of the equipment were then explained.

Carbonitriding is a process wherein a ferrous alloy is heated in an atmosphere of such a nature that it simultaneously absorbs both carbon and nitrogen and then cooled at a rate which will give the desired properties. The absorption of nitrogen lowers the critical temperature, slows down the rate of transformation, and, at low temperatures, forms complex iron nitrides. In these respects nitrogen acts in a manner that is characteristic of carbon in normal carburizing.

Mr. Given made use of the knowledge of carburizing and applied it to carbonitriding. The first experimental cycles were not satisfactory. Too much retained austenite was present to be eliminated by subzero refrigeration. Desirable microstructures and hardnesses were obtained by raising the temperature, lowering the flow of ammonia and employing a diffusion cycle, as is done in carburizing. This resulted in less concentration at the surface and eliminated to a large extent the presence of retained austenite.

The limitations of equipment and the controls necessary for consistent quality use were also discussed.—**Reported by G. F. Trojanowski for Syracuse Chapter.**

Presents Talk on Nondestructive Tests

Chairman Mat Hayes (Left), Checks a Piece of Nondestructive Testing Equipment Used by W. A. Black, Republic Steel Corp., to Illustrate His Talk Entitled "Nondestructive Testing" Presented Before Buffalo Members

Speaker: W. A. Black

Republic Steel Corp.

The quality of nondestructive testing is directly proportional to the quality of sound judgment being exercised by the operator. So warned W. A. Black, director, electrical laboratory, Republic Steel Corp., in his discussion of "Nondestructive Tests" at a meeting of **Buffalo Chapter.**

Mr. Black reviewed the developments at Republic during the past two decades in the field of nondestructive testing. During this period various standard commercially available and specially designed inspection equipment has been used for very specific inspection functions.

Magnaglo, for example, cannot be used to determine seam depth accurately. This spurred Republic in 1946 to the development of a seam depth indicator, which is now commercially marketed under the name of "Sedac". This equipment, working on an eddy current principle, is accurate in measuring seam depth of the magnitude of 1/32 to ⅛ in. However, like every inspection tool, this equipment has its limitations. It can be used on only those seams that are open to the surface. Subsurface seams must be detected by other means. At Republic the Sedac-type equipment has been incorporated into automatic inspection equipment for commercial products such as pipe couplings. In such an automatic setup, the inspection is done without the benefit of human assistance.

Ultrasonics must be resorted to in the case of subsurface seams or other subsurface defects which are below the range of Magnaflux (in depth). Again, through careful study of what can be done and the limitations imposed upon the equipment because of circuitry problems, Republic has been able to modify sonic equipment to such specialized tasks as inspecting hot billets to determine the point at which cropping should take place.

Working models of the equipment used at Republic and case histories which showed the intelligent use and interpretation of nondestructive testing indications and how such correct interpretations can save many companies many dollars were explained by Mr. Black. Conversely, he presented case histories of misinterpretation of test results and the consequences, both financial and otherwise, attendant to such misinterpretations. In closing, Mr. Black warned that the operators of this type of equipment must know not only their equipment and the results that can be obtained, but also the limitations, because no one piece of equipment can do all you want it to do all of the time.—**Reported by G. F. Kappelt for Buffalo.**

Analyzes Fatigue Failure Of Large Parts at Akron

Speaker: H. R. Neifert

Timken Roller Bearing Co.

H. R. Neifert, supervisor of railway research at Timken Roller Bearing Co., spoke on "Fatigue Failure **of Large Parts"** at a meeting held by **Akron Chapter.**

The usual concept of fatigue strength based on mechanical properties of materials was discussed and compared with results of simulated tests of design members. The influence of shape, notch sensitivity of material, and processing conditions on the fatigue resistance of press-fitted assemblies was illustrated. The detrimental effect of unfavorable residual stresses, as well as the practical use of favorable residual stresses to improve fatigue strength, were emphasized.—**Reported by Carl Dorosa for Akron.**

Receives Past-Chairman's Certificate

John L. Morosini (Right), Immediate Past Chairman of the Boston Chapter, Is Shown Accepting His Past Chairman's Certificate From Harold D. Stuck, Present Chairman, During a Meeting Held Recently by the Chapter

Plan First Southwest Metal Show

The Southwest's First Metal Congress, to be Held in the Spring of 1958, Was Planned at Fort Worth When the Executive Committee of the North Texas Chapter Met With C. L. Wells, Assistant Director of Metal Show, American Society for Metals. After a study of convention and display facilities of the Dallas-Fort Worth Area, Mr. Wells reported that he would submit his findings to the A.S.M. Board of Trustees for approval. Shown at the meeting are, seated, from left: C. E. Perkins, secretary; Mr. Wells; J. P. Fowler, chairman; and A. S. Holbert, vice-chairman; Standing, from left: R. E. Hopper, treasurer; George L. C. Dehn; Stephen Maszy; Fred B. McKimball; and Maurice J. Condon. (Reported by Bob Craft for North Texas)

Elements of Technical Report Writing Given in Series at Birmingham

Speaker: R. G. McWilliams

Birmingham-South College

R. G. McWilliams, dean of the department of English, Birmingham-South College, delivered a series of four lectures on "Technical Report Writing" in **Birmingham.**

In his first lecture, "The Formal Report", Prof. McWilliams stated that every report has the single purpose of conveying information accurately and efficiently. It should be planned to fit a specific purpose and a specific audience.

The following elements should be included in the formal report: cover, title page, table of contents, foreword or letter of transmittal, summary, body and appendix.

The outline should be flexible so that within its basic framework the report can be constructed to fit the subject matter, purpose and audience. Minimum requirements for the identifying information on the title and cover pages were given, along with suggestions for the arrangement of this information. A foreword should be brief and provide background and orientation information for the reader. A summary following the foreword should tell what work was done, what tests were performed and should present conclusions and recommendations. The body, the important part of the report, should include an introduction, descriptive narrative, results, discussion, conclusions and recommendations, and should tell a complete story. Detailed information and secondary materials should be placed in the appendix, every section of which should be keyed to the text by specific reference.

The second lecture covered the "Informal Report", which, in general, is less finished than the formal report, but the same functional elements of the formal report should be used. They can be classified into inspection reports, progress reports and periodic reports. The use of printed forms and the new punched-card systems as reports was discussed and an outline for the memorandum report was presented.

Technical information is also transmitted in business letters, and the principles of technical report writing should be followed as closely as possible in this form of writing also.

In the third lecture, "Writing of the Report", the rules of grammar and punctuation were reviewed. The necessity of the proper order of sentence elements was mentioned, and examples of faulty constructions were pointed out and corrected.

The style of writing used in a technical report should be suited to the needs of the potential readers. Simple, direct, clear and short sentences should be the rule, the active rather than the passive voice should be used and footnotes should be kept to a minimum.

The final lecture, "Review and Summary of Technical Reporting", covered problems faced by writers not presented in the preceding lectures. Dr. McWilliams closed the series by recommending dictionaries and textbooks on grammar and report writing which should be useful for the technical writer's library.—**Reported by Robert Fisher for Birmingham Chapter.**

Controlled Atmospheres Described at Rocky Mt.

Speaker: Peter P. Burns

Lindberg Engineering Co.

Peter P. Burns, metallurgical service engineer, Lindberg Engineering Co., presented a talk entitled "Types of Controlled Atmospheres" at a recent meeting of the **Rocky Mountain Chapter.** He described methods of obtaining the various controlled atmospheres, the specific applications of each type and the factors to be considered in choice of method.

Mr. Burns stressed the importance of a preliminary review of the requirements of an operation to ascertain if a proposed atmosphere will perform the desired function. Economic factors, such as initial equipment costs and operational costs for a given size of operation, are also determining criteria in the selection of types of generators.

The majority of generators provide a means of cracking natural gas with air and controlling the quantity of constituents so that the resulting gas will or will not react with the material to be heat treated. Typical units are equipped with a carburetor for mixing the gas and air, a pump to provide flow, fire checkers for preheating, a hot retort containing a catalyst for the cracking, and various condensers and traps for removing contaminants. The endothermic-type generator is the most convenient type of unit and is employed in the majority of instances. The exothermic unit is used for bright heat treating where decarburization is not a factor. It provides the least expensive atmospheres and may be used to produce oxidizing conditions if desired.

Other types of units discussed included the high-nitrogen generator where a hydrocarbon is burned to remove oxygen from air, an ammonia burning unit which also provides a high-nitrogen atmosphere, an ammonia dissociator to provide a mixture of nitrogen and hydrogen for heat treating electric metals, and a charcoal unit for producing nitrogen and carbon monoxide mixtures. Each of these generators is best adapted for specific applications and optimum production loads.

Mr. Burns concluded by describing miscellaneous methods of obtaining various atmospheres, such as by cracking hydrocarbon fluids in furnace chambers, by the use of carbonaceous muffle blocks, and the use of different varieties of tank gases. —**Reported by F. C. Perkins for Rocky Mountain Chapter.**

CHAPTER MEETING CALENDAR

Akron	**Apr. 17**	Sanginiti's	**William D. Manly**	A Metallurgist Builds a Nuclear Reactor
Albuquerque	**Apr. 18**	La Placita	**S. G. Fletcher**	Modern Developments in Tool and Die Steels
Atlanta	**Apr. 1**			Joint Meeting With Old South
Baltimore	**Apr. 15**	Engineers Club	**J. S. Huntington**	Vacuum Melting
Birmingham	**Apr. 29**	Gulas Restaurant	**D. S. Clark**	Yield Phenomenon
Boston	**Apr. 5**	Faculty Club	**J. C. Fisher**	Metallographic Evidence of Dislocations
British Columbia	**Apr. 18**		**L. B. Manning**	
Buffalo	**Apr. 11**	Mann's 300 Club	**W. S. Pellini**	Brittle Fractures
Calumet	**Apr. 9**	Phil Smidt's	**D. S. Clark**	What Do Dynamic Laboratory Tests Tell Us?
Canton-Massillon	**Apr. 2**	Mergus Restaurant	**Panel**	Vacuum Melting and Resulting Materials
Carolinas	**Apr. 00**	State College	**G. Derge**	Training Metallurgists
Chattanooga	**Apr. 16**	Maypole Restaurant	**C. W. Briggs**	Steel Castings
Chicago	**Apr. 8**	Furniture Club	**Brooks McCormack**	Planning Research Facilities
Chicago-Western	**Apr. 16**	University of Chicago	**Seminar**	Mechanisms of Deformation and Fracture
Cincinnati	**Apr. 11**	General Electric Co.	**Tri-Chapter Meeting**	New Processes in Metallurgy
Cleveland	**Apr. 1**	Hotel Hollenden	**W. H. Steuer**	Guided Missiles
Columbia Basin	**Apr. 00**		**B. Lustman**	Zirconium
Columbus	**Apr. 11**	General Electric Co.	**Tri-Chapter Meeting**	New Processes in Metallurgy
Dayton	**Apr. 11**	General Electric Co.	**Tri-Chapter Meeting**	New Processes in Metallurgy
Detroit	**Apr. 8**	Elmwood Casino	**Harry Walp**	Ball and Roller Bearing Steels
East. New York	**Apr. 9**	Panetta's	**H. Kessler**	Melting of Metals
Hartford	**Apr. 9**		**R. Thompson**	Automotive Gas Turbines
Indianapolis	**Apr. 15**	Village Inn	**A. M. Aksoy**	Metallurgy of Vacuum Metals
Jacksonville	**Apr. 2**	Parker & Mick Works	**J. M. Edge**	Steelmaking Control
Kansas City	**Apr. 17**	Golden Ox	**R. T. Telford**	Welding Metallurgy
Lehigh Valley	**Apr. 5**	Hotel Traylor	**C. L. Clark**	High-Temperature Metallurgy
Los Alamos	**Apr. 2**		**R. R. Freeman**	Arc-Cast Molybdenum
Los Angeles	**Apr. 25**	Rodger Young Audit.	**J. J. Heger**	Developments in Stainless Steel
Louisville	**Apr. 2**	White Cottage	**V. Clair**	Welding by Pressure and Impact
Mahoning Valley	**Apr. 9**	V.F.W.	**H. Lombertus**	Heavy Bearings
Milwaukee	**Apr. 16**	City Club	**A. M. Aksoy**	Vacuum Melting in Metallurgy
Montreal	**Apr. 1**	Queen's Hotel	**J. J. Waller**	Metal Bonding of Aircraft Assemblies
Muncie	**Apr. 9**	Student Center	**A. R. Spalding**	Student Night
New Jersey	**Apr. 15**	Essex House	**R. E. Paret**	Chromium-Manganese Stainless Steels
New Orleans	**Apr. 1**	Lenfant's	**D. S. Clark**	Dynamic Properties of Metals
New York	**Apr. 8**	Hotel Delmonico	**Arthur Nowick**	Metal Physics
North Texas	**Apr. 3**		**D. S. Clark**	National Officers Night
NE Pennsylvania	**Apr. 4**	Irem Temple Club	**W. H. Steuver**	Guided Missiles
NW Pennsylvania	**Apr. 25**	Titusville	**R. A. Flinn**	Relation of Metal Structure to Service Performance
Oak Ridge	**Apr. 17**	K. of C. Hall	**E. E. Stanbury**	Temperature Measurement and Control
Ontario	**Apr. 5**	St. Catherines	**G. C. Monture**	Stainless Steel
Oregon	**Apr. 12**	Albany, Ore.		Student Affairs Night
Ottawa Valley	**Apr. 2**	P. M. R. L.	**J. C. Reid**	Heat Treatment
Penn State	**Apr. 10**	Mineral Sciences Audit.	**J. W. Sands**	Alloy Constructional Steels
Peoria	**Apr. 8**	American Legion	**D. A. Campbell**	Types of Industrial Gas Burners
Philadelphia	**Apr. 26**	Engineers Club	**A. E. Nehrenberg**	Super High-Strength Constructional Steels
Philadelphia Jr.'s	**Apr. 8**	Engineers Club	**E. Ottens**	Surface Finishing
Phoenix	**Apr. 27**		**Social**	Ladies Night
Pittsburgh	**Apr. 11**	Gateway Plaza	**Panel**	Rapid Heating of Metals
Rhode Island	**Apr. 3**	Hummock Grill	**L. P. Tarasov**	Current Ideas About Grinding
Rochester	**Apr. 8**	Chamber of Commerce	**G. Stern**	Powder Metallurgy
Rockford	**Apr. 24**	Faust Hotel	**H. Osborn**	Rapid Heating With Electricity
Rocky Mt.	**Apr. 19**		**Social**	Ladies Night
Rome	**Apr. 1**	Trinkaus Manor	**Jack Siekman**	Cemented Oxide Cutting Tools
St. Louis	**Apr. 12**	Shell Oil Co.	**Panel**	Stump the Experts and Plant Tour
Savannah River	**Apr. 11**	Tinnerman's Lodge		National Officers Night
Southern Tier	**Apr. 8**	Vestal, N. Y.	**W. D. Manly**	Nuclear Power
Springfield	**Apr. 15**	Greenfield	**A. E. Nehrenberg**	Secondary Hardening
Syracuse	**Apr. 00**	Onondaga Hotel	**Dunlap**	Temperature Control and Measurement
Texas	**Apr. 2**	Ben Milam Hotel	**D. S. Clark**	Dynamic Properties of Metals
Toledo	**Apr. 11**	Maumee Yacht Club	**Rufus Easton**	Continuous Casting
Tri-City	**Apr. 9**	Alcoa		Plant Tour, Davenport Works
Tulsa	**Apr. 4**	Alvin Hotel	**D. S. Clark**	Dynamic Properties of Metals
Utah	**Apr. 17**	Skyliner	**H. M. Banta**	Pipeline Metallurgical Problems
Warren	**Apr. 11**			Plant Tour
Washington	**Apr. 8**		**F. N. Darmara**	Vacuum Melting
West Michigan	**Apr. 13**			Plant Tour
Wichita	**Apr. 5**		**D. S. Clark**	National Officers Night
Wilmington	**Apr. 17**	DuPont Club	**F. Seitz**	Radiation Damage to Metals
Worcester	**Apr. 10**	Hickory House	**J. H. Hitchcock**	Mile-a-Minute Rolling of Steel
York	**Apr. 10**	Gettysburg	**M. Cohen**	Principles of Heat Treatment

Apr. 27—Purdue University, Combined Indiana Chapters, Spring Symposium

Covers Yield Phenomenon at Detroit

Principals at One of the Educational Lectures on "Yield Point Phenomenon in Metals and Alloys" Given by the Detroit Chapter Were, From Left: Henry Gudebski and Nicholas Lazar, Technical Chairmen; Erie Morgan, Assistant Director of Research, Jones & Laughlin Steel Corp., Speaker; and George Bidigare, the Chairman of the Educational Committee

Speaker: E. R. Morgan
Jones & Laughlin Steel Corp.

Eric Morgan, assistant director of research, Jones & Laughlin Steel Corp., presented an educational series of two lectures on the "Yield Point Phenomenon in Metals and Alloys" before the **Detroit Chapter.**

He started with a description of the four prime characteristics of the yield phenomenon—the upper and lower yield point; loss of a yield point upon immediate retesting of a previously yielded sample; the return of a definite yield point after aging or annealing a previously yielded sample; and the fact that certain impurities must be present to produce a yield point.

Dr. Morgan then described various theories that have been brought forward as explanations of the yield point phenomenon.

In an analysis of these theories it was shown that the one advanced by Dr. Cottrell of England, based on dislocations, was the most acceptable but in itself needed modification before it could explain completely the experimentally observed phenomenon. As explained by Dr. Morgan, the solute atoms, carbon and nitrogen, in the case of deep drawing steels, move about until they encounter a dislocation, at which time they lock in place and in so doing tend to anchor the dislocation or prevent it from being moved by an applied stress. With the application of sufficient stress, however, these dislocations will break away from the locking effect of the solute atoms. After breaking away they encounter various barriers and are temporarily restrained until they build up in sufficient quantity to overcome the barrier. At this time there is an avalanche movement of dislocations with the resultant occurrence of yielding. The fact that time is required to initiate yielding was illustrated with experimental data from a series of tensile tests on SAE 1015 steel. A delayed yield effect was noted as the speed of load application was increased (i.e., 36,000 psi. would cause yielding on a slow test while rapid loading to 51,000 psi. resulted in an incubation period of 5 milliseconds before yielding).

It was pointed out that the yield point was raised and became more detectable as the temperature of the test specimen was lowered. On the other hand, as the temperature of the specimen was increased the yield point decreased and finally a critical temperature was reached at which the yield phenomenon no longer occurred.

To illustrate the fact that solute atoms are necessary to the existence of a yield point, Dr. Morgan presented the case of cadmium crystals being grown in an argon atmosphere showing no yield point as opposed to cadmium grown in nitrogen showing a definite yield point. The fact that a true yield point is frequently missed during normal tensile testing was revealed to be due primarily to two causes, poor alignment of the specimen with resultant bending of the specimen, and the use of a "soft" tensile machine, one which does not instantaneously follow stress variations.

A discussion of strain aging was included in the lecture. It was defined as the re-entering of solute atoms into place at dislocations after having been torn loose by yielding with a resultant increased resistance to initial deformation, the amount of increase being termed as the aging index. The possibility that strain aging, as normally observed in steels, results from precipitation at dislocations, was discussed in terms of the kinetics of strain aging and precipitation of carbon.

Dr. Morgan concluded with a summary of the work being done at the Jones & Laughlin Research Laboratories aimed at the control of strain aging primarily from the standpoint of converting the carbon and nitrogen to a nonsoluble phase before temper rolling.—**Reported by G. M. Lahr for Detroit Chapter.**

Titanium Developments Outlined at Notre Dame

Speaker: T. W. Lippert
Titanium Metals Corp. of America

At a recent meeting of the **Notre Dame Chapter,** T. W. Lippert, manager of sales and technical service, Titanium Metals Corp. of America, presented a talk on "Current Developments in Titanium Alloys".

Mr. Lippert gave a complete history of the titanium industry. He stated that the principal output of the titanium industry is being used by the aircraft industry. One of the reasons that this metal is used is its favorable strength-to-weight ratio. Also, it has desirable corrosion resistance properties.

This alloy is produced by the batch process and does not lend itself to high production methods such as used in the steel industry. However, new methods of production are being explored and metallurgists are developing new alloys for heat resistance.

Mr. Lippert illustrated his talk with slides showing typical parts fabricated from titanium and the properties of same at elevated temperatures.—**Reported by R. C. Pocock for Notre Dame Chapter.**

Points Out Factors for The Selection of Steels

Speaker: C. W. Darby
Crucible Steel Co.

C. W. Darby, staff metallurgist, Crucible Steel Co., addressed the members of the **Atlanta Chapter** on the "Selection of Carbon and Alloy Steels".

Mr. Darby pointed out many interesting features in the selection of a particular steel to do a specified job. The important characteristics of carbon and alloy steels and the fundamental differences between them, as well as the effects of various alloying components were discussed.

Using slides to illustrate, Mr. Darby showed the typical effects of time and temperature on different steels, notch sensitivity, effects of surface finish on bending endurance limit and effects of heat treatment on impact properties. In conclusion, Mr. Darby made a very interesting comparison of laboratory tests and actual usage results.—**Reported by James Johnson for Atlanta.**

Metallurgical News and Developments

Devoted to News in the Metals Field of Special Interest to Students and Others

A Department of *Metals Review,* published by the
American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

A.I.M.E. Reorganizes—The American Institute of Mining, Metallurgical and Petroleum Engineers has reorganized its structure to transform its three Branches into the Metallurgical Society, the Society of Mining Engineers and the Society of Petroleum Engineers of A.I.M.E. Heretofore they have been the Metallurgical Branch, the Mining Branch and the Petroleum Branch. The new setup places the 30,000 members of the new Societies according to individual choice by the members.

Nuclear Power—The first nuclear power system in the U.S. designed and built solely for experimentation in the generation of electric power was put into operation at Argonne National Laboratory of A.E.C. recently. The EBWR, Experimental Boiling Water Reactor, will supply 5000 kw. of electric power to the Laboratory.

Midget Battery—Elgin National Watch Co. and Walter Kidde Nuclear Laboratories, Inc., have announced joint development of a miniature nuclear-powered battery capable of delivering continuous electrical power for at least five years. The battery, approximately the size of a thumb tack head, has a nominal power output of 20 microwatts and is the first such device to be completely safe for extensive personal use without special precautions. It utilizes the decay energy of a beta-emitting radioisotope as its source of energy.

New Company—A new company, Reactive Metals, Inc., has been formed by Mallory-Sharon Titanium Corp. and National Distillers Products Corp. The firm will be initially engaged in the melting of zirconium and its alloys, and the manufacture of certain zirconium mill products; production may be expanded later to include other metals of value to the atomic energy program.

To Relocate—A tract of approximately 550 acres of land near Gaithersburg, Md., has been selected for relocation of the Washington laboratories of the National Bureau of Standards. The move will permit the Bureau to plan buildings to replace present research facilities, which over the past 50 years have become inadequate for current needs.

Advisory Group—Vanadium-Alloys Steel Co., to more effectively handle metallurgical problems associated with the complexity of product development in today's expanding market, has announced the establishment of a Metallurgical Product Development Group, which will be charged with the introduction and application of new toolsteel products to industry.

Announce Periodical—A new periodical, *Induction Heating News,* features articles on new and unusual applications used in the heat treating of metals. The paper, a four-page pamphlet, is published by Induction Heating Corp., 181 Wythe Ave., Brooklyn 11, N. Y.

Purchases New Plant—Standard Steel Treating Co., specialty heat treat concern, has purchased Steel Treat, Inc., a complete production heat treating plant to be operated and known as Standard Steel Treating Co., Plant #2. The new plant houses four distinct heat treating lines comprised of modern, completely atmosphere controlled heat treating equipment. Total daily capacity exceeds 100,000 lb.

X-Ray Lab—Arnold Greene & Co., Inc., has installed the first commercial million volt X-ray laboratory in the country. The company has been prominent in the field of nondestructive testing and recently entered the field of metallurgy and analytical chemistry.

To Offer Degree—Denver Research Institute, in cooperation with the College of Engineering, University of Denver, is contemplating an evening graduate program leading to the M.S. degree in metallurgy, effective next September. Options will be offered in physical and nuclear metallurgy, and it is anticipated that approximately two years will be required to complete requirements for the degree. To meet the schedules of metallurgists and other interested persons who are employed on a full-time basis, classes will be held in the early evening hours. Lectures will be presented by qualified graduate metallurgists on the staff of Denver Research Institute.

To Hold Conferences—Sponsored by Armour Research Foundation, a conference on "Relaxation Phenomena in Ferromagnetic Materials" will be held Apr. 10 and 11, and a conference on "Fluctuation Phenomena in Solids" on Apr. 13. Forty scientists in the field of loss phenomena will participate in the first meeting and 15 top men in the field and two foreign scientists will attend the second conference.

Add Lab—A fully equipped metallurgical laboratory has been added to the facilities of Alloy Steels, Inc., to enable the company's metallurgists to offer prompt assistance to customers with problems related to the hardness, structure or heat treatment of steels for any specific requirements.

New Concept—The time-honored belief that "only diamond scratches diamond" became obsolete when G.E.'s Research Laboratory announced the discovery of an entirely new material never found in nature. "Borazon", a cubic boron nitride, scratches diamond with ease and remains hard at temperatures where diamond literally burns up.

Microanalysis—"Point probe microanalysis", a new metallurgical research technique, permits analysis of steel specimen areas 10,000 times smaller than is possible by other methods. The technique was conceived in France about six years ago and is now being developed and refined at U. S. Steel's Research Center in Monroeville, Pa. It involves the use of an electron microscope containing a focused electron beam to excite X-ray emission from a region as small as a few microns in diameter. The characteristic X-rays emitted are then analyzed by a crystal spectrometer.

Gravity Award—The Gravity Research Foundation has announced its 1957 program of Awards for Essays on Gravity. The awards, the first to be $1000, will be made on June 1 for the best 1500-word essays on the possibilities of discovering some partial insulator, reflector or absorber of gravity; or some alloy, or other substance, the atoms of which can be agitated or rearranged by gravity to throw off heat; or some other reasonable method of harnessing, controlling or neutralizing gravity. Further information may be obtained from: Gravity Research Foundation, New Boston, N. H.

Talks on Modern Heat Treating Methods

Russell G. Cameron, Jr., New England Metallurgical Corp., Presented a Talk on "Modern Heat Treating" at a Meeting Held by Boston Chapter. Present were, from left: R. Pomfret, program chairman; Mr. Cameron; H. Stuck, chapter chairman; and Dow Robinson, technical chairman

Speaker: R. G. Cameron, Jr.
New England Metallurgical Corp.

The increasing importance of the proper use of modern heat treating equipment, combined with correct furnace atmospheres and brazing materials, was demonstrated in a lecture on "Modern Heat Treating and Brazing of Stainless Steel" by Russell G. Cameron, Jr., New England Metallurgical Corp., at a meeting held in **Boston.**

Mr. Cameron showed the marked differences between the four main grades of stainless steel, as follows:

Austenitic is nonhardenable, nonmagnetic and is hardened by cold work only.

Martensitic has a chromium base, is hardenable after heat treatment, is magnetic, and is capable of giving great strength, toughness and corrosion resistance after proper heat treatment. This grade is capable of producing high toughness by tempering at 650° F., leaving a bright surface when done in hydrogen.

Precipitation hardening is a moderate austenitic grade, made stainless by solution heat treatment plus age hardening. It gives good surface hardness and corrosion resistance. Many types of springs are made from this material.

Ferritic is a low carbon chromium-base material, it is magnetic, nonhardenable, and has good corrosion resistance when in the annealed condition. Hydrogen or dissociated ammonia atmospheres are normally used with this material to produce bright work.

All types of atmospheres and their effects on the materials were discussed. A 75% hydrogen, 25% nitrogen atmosphere from dissociated ammonia is used a great deal. Exothermic and endothermic atmospheres, where hydrogen is the critical element, are widely used to produce oxide-free parts. Advantages of using this treatment are that no pickle treatment is required, no surface etch or oxide film is needed, and there is no change in surface chemistry and very little distortion.

Disadvantages of the furnace atmosphere method of brazing include size limitations and the fact that maximum hardness cannot be obtained on the parts, as compared with a liquid or air-blast quench.

In brazing or joining stainless steel parts, two or more metals are involved, and a third metal, often copper, whose melting point is below that of the metal joined, is used. It is not a weld. Some of the advantages are that stampings and screw machine parts can quite often be used in place of forgings and castings, thus giving weight reduction, allowing several components to be joined in a single configuration. Low carbon parts can be joined to high carbon or stainless parts, or cold rolled steel to stainless, giving close tolerance at a limited number of joints. The work must be very clean, be well fitted together, with brazing material in proper place, and no flux is used, inasmuch as hydrogen acts as reducing agent. Capillarity is also important. Surface tension holds parts together, giving interlocking action at surface and great strength of the joined part at room temperature. A brazed joint, properly made, has greater strength than a welded joint or the parent metals. As few fixtures should be used as possible and they should be of same material as brazed parts. Shoulders should be used to "stake" the brazing alloy to the materials to be bonded, and metal-to-metal contact is needed. Braze rings can be imbedded without joints, in grooves. Presently, millions of small parts are being joined by the newer brazing alloys. The chromium-nickel-boron types are available as cast rod, powder, resin bonded sheet, or in forms sintered from powders. The brazed parts can be used in salt baths, up to 2150° F., with safety, or in most acids or corrosive atmospheres. Joint strengths from 75,000 to 95,000 psi. are possible. The strength of the brazed metal exceeds the parent metal up to high temperatures.—**Reported by H. I. Dixon for Boston.**

Minnesota Members Hear Talk on Finishing Methods

Speaker: S. L. Johnson
Minnesota Mining & Mfg. Co.

S. L. Johnson, abrasive division, Minnesota Mining & Manufacturing Co., presented a talk entitled "Production for Finish" at a meeting of the **Minnesota Chapter.**

Mr. Johnson summarized the activities of the steel mills in the use of coated abrasives. Stainless steel coil has long been salvaged by grinding with coated abrasive belts. This type of operation has become so economical that it is integrated into regular production procedures. One large mill has even experimented with a superficial billet grinding, followed by grinding the coil at 0.250 gage, to remove up to 0.040 in. on a side.

A recent development is the polishing of hot rolled, pickled carbon steel for automobile bumpers in gages of 0.093 to 0.110 in. using grinders in tandem. Pinch rolls bring the steel through a series of grinding heads (as many as 15 or more in a row), and bring the surface down to a platable finish. Cost can thereby be cut in half.

This same system is used for carbon steel, both coil and sheets, in the appliance trade, with similar savings, not only in the cost of steel but in labor as well. This process readily adapts itself to all the new techniques in plating. Die life is increased and the difficult high-styled contours of modern design are easier to process when all the finishing is done before drawing. Some of the automobile manufacturers have experimented with the same method for body stock, particularly hoods and fenders. It has also been adopted by some warehouses for reclaiming stock that has been rusted and for upgrading metals.

Another method, called the strip scourer, is used by many major mills for rolling Type 430 stainless for automotive trim. This process can be described as a deep penetration cleaning device where the rolled-in dirt, pickle etch and oxides are removed at speeds up to 500 f.p.m. exposing the clean parent metal to the final bright rolls. A dark luster results that matches the nickel plated chromium on the rest of the hardware and eliminates any cloudy or tinny appearance.—**Reported by H. F. Eilers for Minnesota.**

Meet Your Chapter Chairman

VANCOUVER ISLAND

RALPH D. BARER, although born in Austria, has been a resident of Canada since 1928. He graduated from University of British Columbia with honors in metallurgical engineering and studied physical metallurgy at M.I.T. After graduating he joined McKinnon Industries, St. Catherine, as a foundry trainee, and later went to Polymer Corp., Sarnia, as an inspection engineer. From 1948 to 1950 he served as instructor in physical metallurgy at the University of British Columbia. He was associated with Consolidated Mining & Smelting Co. as a physical metallurgist until joining the Pacific Naval Laboratory of the Defense Research Board of Canada, where he is concerned with metallurgy, corrosion and nondestructive testing for the Canadian Navy.

Mr. Barer is married, has three children, and, when time permits, indulges in such interests as gardening, coho fishing, furniture making or high fidelity music. He is a member of A.I.M.E. and the Association of Professional Engineers.

RHODE ISLAND

SIDNEY SIEGEL, manager of engineering in the Nuclear Products Division, Metals & Controls Corp., Attleboro, Mass., was born in Boston. He has his B.S. in metallurgy from M.I.T. His first work after school was in research at the Naval Research Laboratory, Anacostia, D. C. He has been staff associate of the Manhattan Project at M.I.T., and was assistant manufacturing superintendent in the general plate division of Metals & Controls Corp. before assuming his present position.

Mr. Siegel has been active in A.I.M.E., and A.S.T.M. as well as civic organizations in Sharon, Mass. He was an ensign in the Navy from 1944 to 1945. He has two boys, and golfs, sails or gardens in his spare time.

GOLDEN GATE

WILLIAM C. MATHESON, partner in Matheson-Doherty Co., San Francisco, was born in Chicago. He has a B.S. degree from Beloit College in Wisconsin as well as extra credits from New York University and University of California.

His first job was as engineer with Eclipse Fuel Engineering Co., Rockford, Ill., and he was president and general manager of W. C. Matheson Co. before and for some time after his two years of military service as a junior officer on the staff of Admiral Nimitz.

Bill has been a member of A.S.M. since 1940, and he is also a member of the Plumbing and Heating Club in San Francisco and B.P.O.E. of San Mateo. He has two sons, 12 and 3, and a daughter 10. His hobbies are duck hunting, fishing and golf.

SYRACUSE

JAMES A. MISKELLY was born in Cork, Ireland, and received his education at Syracuse University. His first job after finishing school was in the meter department for Niagara Mohawk Co. He is now consulting metallurgist in the Electronics Division, General Electric Co.

He has two children and is interested in photography and music.

CEDAR RAPIDS

ELMER M. BRUCE, mechanical engineer, Collins Radio Co., is a native and life-long resident of Cedar Rapids. He served 42 months in the Coast Artillery Corps during World War II, including action in the Pacific Theater. A graduate from the State University of Iowa in 1948 with the degree of B.S.M.E., his first employment was in the time study and inspection departments of the Iowa Manufacturing Co. He was a tool engineer with the Allis-Chalmers Manufacturing Co. until joining Collins Radio Co. in 1955.

Elmer has served on the executive committee of Cedar Rapids Chapter and has also held offices in the Cedar Rapids Chapter A.S.T.E.

Married, and the father of one son, his avocations include woodworking, bowling and fishing.

NORTHEAST PENNSYLVANIA

FRANK C. BRAUTIGAM was born in Rochester, N. Y., and graduated from University of Rochester with a B.S. degree is mechanical engineering. He worked as a metallographer for the dean of engineering and was catcher on the baseball team for three years.

He started his business career as assistant metallurgist for Commercial Controls Corp., spent some years as chief metallurgist and materials engineer for Fasco Industries in Rochester, and is now chief metallurgist for U. S. Hoffman Machinery Corp., Scranton. He served on various committees for Rochester Chapter and helped establish the Northeast Pennsylvania Chapter. He is a past chairman of the Organic Finishing Society and a member of the American Electroplaters Society. Two years were spent in the Army in the Pacific as technical sergeant, and he took part in landings on Okinawa and in the occupation of Korea.

Mr. Brautigan has a small daughter and a son, and he enjoys golf, photography and bowling as hobbies.

JACKSONVILLE

CHESTER S. SHIRA, born in Zanesville, Ohio, has spent the last three years with Lincoln Electric Co., Jacksonville, as welding engineer and in sales. His B.W.E. degree was acquired at Ohio State University, where he was active in intermural football, baseball and golf. He is a member of honorary and technical organizations.

Chet spent two years in the U.S. Navy. He is married, has one son, and is an avid golfer.

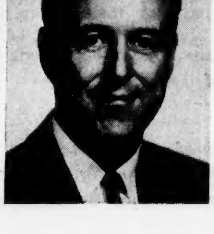
COLORADO SCHOOL OF MINES

JOHN W. MUNN was born in De-Funiak Springs, Fla. After completing his education at Colorado School of Mines he worked with the Denver Research Institute. He is interested in choral singing and dramatics and enjoys fishing and hunting.

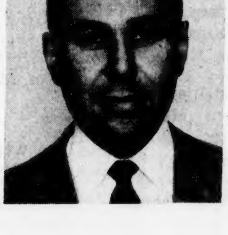
Mr. Munn is a captain in advanced R.O.T.C., and is single.

R. D. Barer

W. C. Matheson

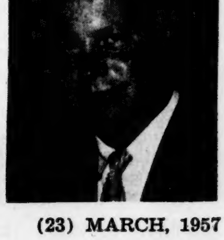


S. Siegel



J. A. Miskelly

C. S. Shira



Quarterly Preprint List

Order Papers by Number
Address Requests to:
Box PP, A.S.M.
7301 Euclid Ave.
Cleveland 3, Ohio

The Board of Trustees of the American Society for Metals, at their Aug. 30-31, 1956, meeting, authorized the quarterly preprinting of technical papers that have been approved by the Transactions Committee. Papers may be submitted to A.S.M. at any time and will be placed on review of the Transactions Committee as they are received. Accepted papers will be preprinted immediately.

The 13 papers herewith listed are now available for distribution to the members of the Society requesting them. A brief abstract of each paper is included.

1. Grain Growth and Recrystallization Studies on Commercial Titanium, RC-55, and Alloy, Ti-100A, by E. L. Bartholomew, Professor of Mechanical Engineering, University of Connecticut, Storrs, Conn.

The influences of prior-to-deformation grain size, amount of cold deformation, annealing temperature and time on the grain size of cold worked and annealed titanium (RC-55) and alloy (Ti-100A) were investigated. Isothermal annealing of cold rolled titanium (RC-55) was also carried out to establish recrystallization rates and to investigate grain growth in the absence of recrystallization.

Annealing temperature and prior-to-deformation grain size are shown to influence the magnitude of the coarsening that tends to occur when titanium (RC-55) and alloy (Ti-100A) are annealed following a critical amount of plastic deformation.

2. A Hot-Hardness Survey of the Zirconium-Uranium System, by W. Chubb, Battelle Memorial Institute, Columbus, Ohio, G. T. Muehlenkamp, General Electric Co., Cincinnati, Ohio, and A. D. Schwope, Clevite Research Center, Cleveland, Ohio.

A complete hardness survey of the zirconium-uranium system has been made at temperatures from room temperature to 900° C. The composition of maximum hardness increases from 40 at. % zirconium at room temperature to 60 at. % at 600° C. At 700° C., the hardness data indicated the presence of the beta uranium phase in alloys containing 95 and 100 at. % uranium. This phase was found to be unusually hard. At 900° C., maximum hardness of the gamma zirconium-uranium solid solution was found to occur at about 50 at. %.

3. Temperature Stresses in the Two-Phase Alloy, WC-Co, by J. Gurland, Assistant Professor, Division of Engineering, Brown University, Providence, R. I.

Thermally induced stresses in the WC constituent of sintered WC-Co alloys were calculated from elastic theory and measured by X-ray diffraction techniques. The compositions of the alloys ranged from 5 to 37 vol. % cobalt. It was found that compressive stresses act on the dispersed carbide phase of high binder compositions but that tensile stress components become predominant in low binder alloys.

4. Electrolytic Extraction of Carbides From Carbon Steel, by R. W. Gurry, Quaker Chemical Co., Conshohocken, Pa., J. Christakos, W. M. Kellogg Co., Jersey City, N. J., and C. D. Stricker, American Steel & Wire Div., U. S. Steel Corp., Cleveland.

Repetitive extraction of the same carbon steel, heat treated to contain very fine carbides, and chemical analysis of residue have served to evaluate many factors pertaining to the conditions of extraction. This work has led to a simple, effective apparatus and technique for electrolytic extraction of carbides from carbon steel. Tests show proposed method results in less decomposition of carbide than other established methods. Performance of the new method upon steels tempered over a range of temperature is demonstrated.

5. Deformation and Fracture of Alpha Solid Solutions of Lithium in Magnesium, by F. E. Hauser, P. R. Landon and John E. Dorn, University of California, Dept. of Engineering, Institute of Engineering Research, Berkeley, Calif.

Alpha solid solutions of Li in Mg are ductile, whereas coarse polycrystalline aggregates of Mg are brittle at 78° K. The improved ductility of the Li alloys of Mg is associated with the introduction of prismatic $(10\bar{1}0)$ $\langle 2\bar{1}\bar{1}0 \rangle$ slip in addition to basal (0001) $\langle 2\bar{1}\bar{1}0 \rangle$ slip. Evidently in the absence of prismatic slip, dislocation arrays pile up against the grain boundaries causing high localized tensile stresses that exceed the cohesive strength of the metal. But the introduction of prismatic slip permits deformation of the adjacent grains and thereby reduces the tendency toward formation of piled-up arrays of dislocations. The incidence of prismatic slip is unique for Mg-Li alloys, since Li is the only effective alloying element for reducing the axial ratio of Mg.

6. Growth of Cadmium From the Vapor, by J. E. McNutt, Engineering Research Laboratory, E. I. du Pont de Nemours & Co., Wilmington, Del., and R. F.

Mehl, Department of Metallurgical Engineering, Carnegie Institute of Technology, Pittsburgh, Pa.

Technique for making continuous microscopic and interferometric observations of cadmium crystals while they are actually growing by deposition from cadmium vapor at constant temperature and supersaturation. Selected observations on changes occurring on basal hexagonal surfaces during experiments with various supersaturations and deposit temperatures within 50° C. of the melting point are reported.

The propagation of steps across basal surfaces was the principal mechanism of growth observed at high deposit temperatures. As the deposit temperature decreased there was an increasing tendency for growth to occur by the propagation of sloping growth fronts. New types of defects called trigonal wakes and ramps were found at the lowest substrate temperatures (274° C.). Other imperfections, designated as ridge boundaries, were found in deposits which had undergone large temperature changes.

7. Solubility of Carbon in Thorium, by Robert Mickelson and David Peterson, Institute for Atomic Research, Dept. of Chemical Engineering, Iowa State College, Ames, Iowa.

Solubility of carbon in thorium has been investigated and limit of solubility determined at four temperatures. Thorium-carbon samples, containing from 0.025 to 1.23 weight % carbon, were prepared by arc melting sponge thorium with high-purity graphite. X-ray data, hardness readings, and metallographic examinations of heat treated specimens were combined to obtain the following solubility limits: room temperature—0.35% carbon, 800° C.—0.43% carbon, 1018° C.—0.57% carbon, and 1215° C.—0.91% carbon.

8. Method for the Etching of Metals by Gas Ion Bombardment, by John B. Newkirk and W. G. Martin, General Electric Research Laboratory, Schenectady, N. Y.

An improved method for the etching of metal surfaces by bombardment with gas ions is described. Novel features, including the use of krypton as the etching agent, and the application of a magnetic field in the ionization chamber, have made it possible to etch metallographic specimens more rapidly and with less heating of the specimen than has been reported heretofore.

9. Some Aspects of Preyield Phenomena in Mild Steel at Low Temperatures, by W. S. Owen, Morris Cohen, and B. L. Averbach, Department of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

The influence of ferrite grain size, austenitizing temperature and cooling rate on the elastic limit and preyield phenomena has been surveyed. Total nonelastic strain at the static yield stress is dependent upon the austenitizing temperature and cooling rate rather than the grain size. The elastic limit at $-196°$ C. varies relatively little with grain size, but the elastic limit at room temperature shows a pronounced grain-size dependence. The implications of these data are briefly discussed in qualitative terms by reference to the Clark-Wood dislocation model.

10. Strain Hardening of Austenitic Stainless Steel, by G. W. Powell, Nuclear Metals, Inc., Cambridge, Mass., E. R. Marshall, Associate Professor of Civil Engineering, University of Vermont, Burlington, Vt., and W. A. Backofen, Metals Processing Laboratory, Massachusetts Institute of Technology, Cambridge, Mass.

The strain-hardening characteristics of types 301 and 304 austenitic stainless steel have been studied as functions of temperature (20 to $-263°$ C.), strain rate (100-fold variation), and stress system (tension, torsion and compression), and correlated with quantitative measurements of the progress of the martensitic transformation.

The stress-strain relationship is strongly dependent upon the stability of austenite with respect to transformation. Effects of the experimental variables are explained in terms of their influence upon austenite stability. At $-263°$ C., tensile deformation is characterized by discontinuous yielding and multiple necking; such instability is attributed in large measure to localized softening caused by heat evolved in testing at temperatures where specific heat is low and flow stress is highly temperature-dependent.

11. Effect of Manganese on the Curie Point of Cementite, by Earl C. Roberts, Associate Professor, Metallurgical Engineering, University of Washington, Seattle, Wash.

By determining the curves showing the gradual loss of cementite ferromagnetism with temperature for three series of annealed steels, a generalized graph relating the Curie temperature of the cementite to the manganese content of the cementite has been drawn. The manganese content for the cementite was determined by chemical analysis of the extracted residue from the steels. It is shown that the per cent manganese in the cementite of an annealed steel is a function of both the manganese and carbon percentages of that steel. Empirical equations are presented to show the relationship between the manganese content of the cementite and (a) the manganese content of the steel, (b) the manganese content of the ferrite phase, (c) the Curie temperature of the cementite.

12. Apparatus for Determining the Hardness of Metals at Temperatures up to 3000° F., by M. Semchyshen and C. S. Torgerson, Climax Molybdenum Co. of Michigan, Office and Experimental Laboratory, Detroit, Mich.

An apparatus for determining the hardness of metals from room temperature to 3000° F. is described. The principles of the pyramid penetration method of hardness testing have been embodied in the apparatus by the use of synthetic sapphire for the penetrator. The hardness determinations are carried out in a purified argon atmosphere which protects the test specimen and heating element from oxidation.

The hardnesses of pure iron and of the S-816 alloy are reported from room temperature to 2300° F. The sensitivity of the apparatus is demonstrated by the hardness values obtained for pure iron at the temperature of the α to γ transformations. Hardness values for molybdenum and tungsten are reported up to 3000° F.

13. Classification of Precipitation Systems, by R. O. Williams, Cincinnati Milling Machine Co.

It is proposed that all precipitation systems be classified according to three structural characteristics: degree of complexity of nucleation, the shape of the particles formed and the degree of order in the matrix and precipitate. It is expected that these characteristics are most intimately associated with the kinetics and physical properties.

Reports on Hardness Testing in Texas

V. E. Lysaght, Sales Manager, Wilson Mechanical Instrument Division, American Chain & Cable Co., Spoke on "Hardness Testing" at a Meeting of the Texas Chapter. Present, from left: W. D. Gilder; C. L. Horn, vice-chairman; C. W. Eichbaum, Jr.; Russell F. Goff, chairman; Mr. Lysaght; Joe B. Marx, secretary-treasurer; R. C. Anderson, K. Ward; and C. M. Cook

Speaker: V. E. Lysaght

American Chain & Cable Co.

The subject of "Hardness Testing" was discussed by V. E. Lysaght, sales manager, Wilson Mechanical Instrument Division of American Chain and Cable Co., at a meeting of **Texas Chapter.**

The speaker pointed to the fundamental differences that exist between various hardness testing methods and explained the conditions important for accurate testing. These included:

(1) The surface must be normal to the indenter within 5°.
(2) The material must not move or slip while being tested.
(3) The time during which the specimen is under full load must be in accordance with specifications.
(4) The rate of load application must also follow specifications.
(5) The spacing of indentations must be such that the effect of work hardening becomes negligible.
(6) The specimen should be homogeneous, unless it is the purpose of the hardness test to determine special surface conditions such as decarburization.
(7) The preparation of the surface must not affect the hardness of the specimen.

In addition to these general rules, special conditions often require special precautions. When testing sheet, for example, the depth of the indentation must not exceed 1/10 of the thickness of the sheet. In round surfaces the error introduced by the curvature may become substantial. This error increases as the radius of curvature becomes smaller and is particularly pronounced in soft materials.

A large portion of this interesting talk dealt with special fixtures for hardness testing under unusual conditions. A number of slides illustrated clearly the many possibilities that exist for hardness testing at places which cannot be reached by standard testing machines. In addition, special fixtures are frequently designed to hold intricate pieces, such as bevel gears or cams, at the proper angle with respect to the indenter.

Production-line indentation hardness testing has progressed surprisingly in the last years. Semi-automatic Rockwell equipment makes it possible to test as many as 800 pieces per hr. A new, completely automatic Rockwell testing machine, operating on the same principle as manual machines, is equipped with three chutes, so that up to 1000 parts per hr. may be classified into categories of "too hard", "too soft", and "satisfactory". Mr. Lysaght concluded with a discussion of microhardness testing. —**Prepared by F. R. Brotzen for Texas Chapter.**

Advances in Precipitation Hardening Steel Is Topic

Speaker: Paul Ramseyer

Armco Steel Corp.

Paul Ramseyer, production supervisor, development engineering department, stainless steels division, Armco Steel Corp., presented a talk on the "Latest Developments in Precipitation Hardening Stainless Steels" at a **Tulsa** meeting.

Mr. Ramseyer's talk covered heat treatment and hardening procedures, and the resultant mechanical and metallurgical properties and applications of the finished product for several types of corrosion resistant steels. He then pointed out that further advances in the field of heat and corrosion resistant alloys are now in process and show promise of further widening the field of application of the precipitation hardening steels.—**Reported by A. N. Stevens for Tulsa Chapter.**

IMPORTANT MEETINGS *for April*

Apr. 2-4—American Hot Dip Galvanizers Association Inc.: Annual Meeting, Empress Hotel, Miami Beach, Fla. (S. J. Swensson, Secretary, 1806 First National Bank Bldg., Pittsburgh 22).

Apr. 2-5—Society of Automotive Engineers: Aeronautic Meeting and Production Forum, Hotel Commodore, New York. (J. A. C. Warner, Secretary S.A.E., 485 Lexington Ave., New York 17).

Apr. 7-10—National Screw Machine Products Association: Annual Meeting, Shoreham Hotel, Washington. (O. B. Werntz, Executive Vice-President, 2860 E. 130th St., Cleveland 20).

Apr. 8-10—American Institute of Mining, Metallurgical and Petroleum Engineers: Openhearth and Blast Furnace Conference, William Penn Hotel, Pittsburgh. (E. O. Kirkendall, Secretary A.I.M.E., 29 W. 39th St., New York 18).

Apr. 8-10—Metal Treating Institute: Spring Meeting, Boca Raton Hotel, Boca Raton, Fla. (C. E. Herington, Executive Secretary M.T.I., 271 North Ave., New Rochelle, N. Y.)

Apr. 8-12—American Welding Society: Spring Technical, National Meeting and Welding Show, Sheraton and Bellevue-Stratford Hotels, Philadelphia. (J. G. McGrath, National Secretary A.W.S., 33 W. 39th St., New York 18).

Apr. 15-17—American Society of Lubrication Engineers: Annual Meeting, Sheraton-Cadillac Hotel, Detroit. (W. P. Youngclaus, Jr., Secretary A.S.L.E., 84 E. Randolph St., Chicago 1).

Apr. 16-17—American Institute of Mining, Metallurgical and Petroleum Engineers: Metals Conference, Carter Hotel, Cleveland. (E. O. Kirkendall, Secretary A.I.M.E., 29 W. 39th St., New York 18).

Apr. 29-May 1—Association of Iron and Steel Engineers: Spring Conference, Hilton Plaza Hotel, Cincinnati. (T. J. Ess, Managing Director A.I.S.E., 1010 Empire Bldg., Pittsburgh 22).

Apr. 30-May 1—Metal Powder Association: Annual Meeting and Exhibit, Drake Hotel, Chicago. (Kempton H. Roll, Secretary M.P.A., 130 W. 42nd St., New York 36).

A. S. M. has produced and makes available for showing before chapters and educational institutions moving picture films pertaining to metals.

Nominating Committee for A.S.M. National Officers

In accordance with the Constitution of the American Society for Metals, President Donald S. Clark has selected a nominating committee for the nomination of president (for one year), vice-president (for one year), treasurer (for two years), and two trustees (for two years each). This committee was selected by President Clark from the list of candidates submitted by the chapters. The personnel is: Chairman: Robert M. Brick (Chicago-Western Chapter), 326 East 6th St., Hinsdale, Ill.; Francis C. Albers (Rome Chapter), Chicago Pneumatic Tool Co., Utica, N. Y.; Edward E. Hall (Northwestern Pennsylvania Chapter), 329 West Walnut St., Titusville, Pa.; Herbert S. Kalish (Long Island Chapter), Sylvania Electric Products, Inc., Bayside, N. Y.; Robert W. Lindsay (Penn State Chapter), 521 East Prospect Ave., State College, Pa.; R. E. Lorentz, Jr. (Chattanooga Chapter), 306 Crestwood Dr., Chattanooga, Tenn.; Benjamin F. Rassieur (St. Louis Chapter), 5711 West Park Ave., St. Louis, Mo.; William E. Taylor (Phoenix Chapter), 3025 East Mariposa, Phoenix, Ariz.; Walter P. Wallace (Columbia Basin Chapter), 1923 Hood St., Richland, Wash.

The committee will meet during the third full week in the month of May. It will welcome suggestions for candidates in accordance with the A.S.M. Constitution, Article IX, Section 1(b), which provides that endorsements of a local executive committee shall be confined to members of its local chapter, but individuals of a chapter may suggest to the nominating committee any candidates they would like to have in office. Endorsements may be sent in writing to the chairman or any member of the committee.

Record Crowd Hears Talk On Machining at Phoenix

Speaker: Harold Stark

Elox Corp. of Michigan

Over 65 members and guests turned out to hear Harold Stark, sales engineer, Elox Corp. of Michigan, speak on "Electrical Discharge Machining" at a meeting in **Phoenix.**

Mr. Stark called electrical discharge machining the first really new machining method of this century. He pointed out that any conducting material could be cut, regardless of hardness, and that an extremely smooth crack-free surface could be obtained.

A film produced by the United States Bureau of Mines in cooperation with Union Carbide, entitled "The Petrified River", which showed the creation of the Colorado Plateau area and the formation of strata of uranium, was shown—**Reported by R. F. Russi, Jr., for Phoenix.**

Cites Value of Employment Interviews

Lew Gay, Manager, Allis-Chalmers Manufacturing Co., Denver Office, Presented an "Evaluation of the Engineer on the Basis of the Interview" at a Meeting of the Colorado School of Mines Chapter. Shown are, from left: C. Daugherty, special events chairman; John Munn, chairman; and Mr. Gay

Speaker: Lew Gay

Allis-Chalmers Mfg. Co.

Lew Gay, manager, Allis-Chalmers Manufacturing Co., Denver office, talked on "Evaluation of the Engineer on the Basis of the Interview" at a meeting of the **Colorado School of Mines Chapter.**

Mr. Gay discussed Allis-Chalmers' engineering recruiting program and stressed company policies in interviewing prospective employees. The Denver branch is one of 75 district offices. Each office is responsible for interviewing students at one or more of the 100 colleges and universities visited by Allis-Chalmers representatives each year.

Since the company manufactures more than 300 different products, it requires different types of engineers and personalities. Mr. Gay stressed the fact that Allis-Chalmers considers grade point averages as a significant factor. The accumulative average of a student indicates how well he has applied himself during his four years at college. The company will hire anyone in the top 10% of his class, regardless of his personality. This is the type of a man who will be employed in the research and design departments.

Allis-Chalmers grades each applicant on the basis of general impression, general ability, background as applicable to Allis-Chalmers, and interest in the company.

In the category of general impression, Mr. Gay discussed appearance, personality, poise and maturity. In general, the applicant's ability to conduct himself during the interview and indulge in intelligent conversation is important in the eyes of the company. His neatness in dress is another important factor.

General ability is divided into speech, mental alertness and intelligence. The company takes a long look at the cumulative average and tests the applicant's interest in current events.

Since 90% of college applicants have little or no outside experience, little attention is paid to this subdivision.

The most important single feature of the interview is the interest that the individual expresses in Allis-Chalmers. It is advisable to learn as much information as possible about the company prior to the interview.—**Reported by R. B. Steck for Colorado School of Mines.**

Compliments

To HAROLD B. EMERICK, director of technical services for Jones & Laughlin Steel Corp., on his election as national chairman of the Iron and Steel Division, A.I.M.E. Mr. Emerick, co-editor of the book "Basic Open Hearth Steelmaking", is a member of the Pittsburgh Chapter.

◆ ◆ ◆

To ARTHUR A. CROWE, on being chosen the outstanding student of the Erie County Technical Institute last year. The Buffalo Chapter, which sponsors the award, also made Mr. Crowe an honorary member for the current year.

◆ ◆ ◆

To MORRIS COHEN, professor of physical metallurgy at Massachusetts Institute of Technology, on being selected to deliver the annual lecture of the Institute of Metals Division, A.I.M.E., during its recent annual meeting. Dr. Cohen, who has received the Howe Medal and presented the Campbell Memorial Lecture for A.S.M., is a past chairman of the Boston Chapter. He gave a talk on "Nucleation of Solid-State Transformations".

Presented A.S.M.'s Treasurer's Medal

During a Meeting Held by the Washington Chapter, William Pennington, University of Maryland, Was Presented With the Gold Treasurer's Medal by Nat Fick, Chairman of the Chapter. R. Aborn, U. S. Steel Corp., spoke on the "Metallurgy of Ferrous Welding". Shown at the presentation are, from left: F. P. Huddle, Office of the Assistant Secretary of Defense; Prof. Pennington; Nat Fick, chairman; Morgan Williams, chairman of the Washington Chapter A.W.S.; and Dr. Aborn. (Reported by F. P. Huddle)

Speaker: R. H. Aborn
U. S. Steel Corp.

R. H. Aborn, director, Edward C. Bain Fundamental Research Laboratory, U. S. Steel Corp., presented a talk on the "Metallurgy of Ferrous Welding" at a joint meeting of the American Welding Society and the **Washington Chapter.** Dr. Aborn made the following comments:

We have looked for some time at ferrous welding metallurgy of today. Now we wish to indulge in a few glimpses into welding metallurgy of tomorrow.

There should be great improvements in electrodes to weld high-hardenability steels almost as easily as low-hardenability steels are now welded, and also to permit full martensitic hardening of weld metal in post treatment. This will lead to enhanced properties of weld metal because of the superior toughness of tempered martensite and low bainite.

Most superior electrodes require expert handling, so there should be improved-quality safeguards to insure the making of satisfactory manual welds by inexperienced welders in a national emergency. One of the most promising of these safeguards is contact welding electrodes, which are now available in types with powdered iron coatings, enhancing their efficiency by high deposition rate.

There should be a great expansion of automatic welding processes and automatically heat treated resistance welding. Induction welding, though only on the horizon in America, is on a production basis in Europe.

Ultrasonic spot welding has appeared on the horizon for metal foils. It is another form of cold welding in which the interfering surface films are pushed aside by high-frequency vibrations, which largely confine the plastic deformation of the metal to the weld interface zone.

Probably the development which holds the greatest promise since World War II is metal-arc welding with a consumable electrode shielded by argon or helium, as it is potentially capable of depositing any desired composition continuously at high rates in all positions.

Finally, we may look for atomic fission welding, using nuclear fission as a controlled source of heat, and it does not appear to be so far around the corner.—**Reported by F. P. Huddle for Washington.**

William Pennington, past treasurer A.S.M., was presented with the National Treasurer's Gold Medal during this meeting. Because his acceptance speech reflects the feeling that so many of the national officers have for the Society, it is reproduced herewith:

For more than 20 years now, I have been closely associated with the American Society for Metals and have had my share of fun through my associations with men like you. I have thoroughly enjoyed working with local groups at Dayton, Pittsburgh, Syracuse and now Washington.

Some changes—lots of them—have taken place through these years. Twenty years ago we enjoyed such things as reindeer meat at our dinners in Dayton. With all these changes, the A.S.M., as might be expected, has changed too, always for the better, always looking forward and attempting to give its membership greater service.

Why do I like A.S.M.? Mister, I love A.S.M. I love A.S.M. as a National Institution because of the things that it stands for and the way it carries on its functions and the service it renders its membership and the beloved country in which we live. I have accepted quite a few assignments from the national office and not even once have I felt pressure to carry out any project in an arbitrary way. The human soul is respected. A man is asked to do a job and then given all the liberty in the world to do it.

It was fun to be treasurer. Everytime I would say something about a million dollars in a meeting of the Board of Trustees, I would subconsciously feel on my hip to see if "my own ten" was still there. I took great pride in looking after the pennies as well as the dollars. I would have you know that in 1955 we appropriated $350,490.01 to the building fund.

With men like Bill Eisenman, Ernie Thum, Ray Bayless, Taylor Lyman and Walter Morrison holding the fort in the national office, A.S.M. will grow. In Bill Eisenman's words, "Cease to grow could never be the motto of the A.S.M. of Tomorrow".

At the present time, I am serving under Dr. Lyman as chairman of nine A.S.M. committees on definitions. Have you ever been chairman of nine committees at one time? Try it. You will really have fun.

There are some 150 men from the eastern part of the country working with me on these committees. I have worked on quite a few committees in other organizations, but never have I even dreamed of cooperation as splendid as these men are giving.

It is with a great deal of pride that I point out that the Washington Chapter has certainly furnished its share of good men for this work. You can understand why I enjoy the work so much when you know that such men as **John Bennett, Leland A. DePue, Irving J. Feinberg, Nathaniel C. Fick, Julius J. Harwood, Harry K. Herschman, James W. Jenkins, Raymond B. Koehler, Melvin R. Meyerson, Samuel J. Rosenberg, and Henry E. Strauss** are working with me.

Thanks, boys, for assisting me in this work. Thanks to them and all the other boys present here tonight for making this occasion possible. For this medal and what it represents I say, Thanks, just Thanks!

Boston College Plans Course

Boston College has announced a special two-weeks intensive course in "Modern Industrial Spectrography", to be held at Chestnut Hill, Boston, Mass., from July 15 to July 26. The course, designed for chemists and physicists from industry, will cover the techniques of emission spectroscopy as an analytical tool.

Further information may be obtained from Prof. James J. Devlin, S. J., Physics Dept., Boston College, Chestnut Hill 67, Mass.

Southern Metals Conference Scheduled

The following is a tentative program of the Southern Metals Conference to be held May 6 through May 8 at the George Washington Hotel, Jacksonville, Fla. Participating chapters include Atlanta, Birmingham, Carolinas, Chattanooga, New Orleans, Oak Ridge, Savannah River and Old South, with Jacksonville Chapter acting as this year's host. Student chapters from Virginia Polytechnical Institute, Southern Technical Institute, University of Florida and Jacksonville University have also been invited.

Monday, May 6

7:30—11:30 a.m.

Chapter Officers Breakfast and Orientation Meeting. Meeting to be conducted by D. S. Clark, National President, and W. H. Eisenman, National Secretary. All chapter officers, both present and incoming, are invited to attend this meeting.

12:00 m.—2:00 p.m.

Welcome Luncheon, Chet Shira, Presiding.

"New Horizons in Jacksonville", by William M. Johnson, President, Chamber of Commerce.

2:00—5:00 p.m.

Technical Sessions, Bernard Boisvert, Chairman.

"New Horizons in Nondestructive Testing", by C. E. Betz, Magnaflux Corp.

"New Horizons in Electronic Fluoroscopy", by Alexander Gobus, North American Philips Co.

"New Horizons in the Inspection of Thin-Wall Tubing for Critical Application in Nuclear Reactors", by A. Taboada, Oak Ridge National Laboratories.

"New Horizons in Process Control Through Nondestructive Testing", by Robert G. Strother, Magnaflux Corp.

7:00 p.m.

Get Acquainted Gathering—No Formal Program—Card Tables and Refreshments.

Tuesday, May 7

9:00—12:00 m.

Technical Sessions, William C. Tiffin, Chairman.

"New Horizons in Hardness Testing", by V. E. Lysaght, Wilson Mechanical Instrument Co.

"New Horizons in Tensile and Compression Tests", by E. M. Redstreake, Tinius Olsen Testing Machine Co.

"New Horizons in Fatigue Testing", by F. E. Richart, University of Florida.

"New Horizons in X-Ray Spectroscopy", by D. C. Miller, North American Philips Co.

12:00—2:00 p.m.

Luncheon, George Black, Presiding.

"New Horizons for Southern Industry", by Gene O'Brien, Southern Power & Industry.

2:00—4:30 p.m.

Technical Sessions, Joseph Campbell, Chairman.

"New Horizons in Aluminum Dip Brazing", by A. R. Fairchild.

"New Horizons in Ductile Cast Iron", by L. J. Green, International Nickel Co.

"New Horizons in Nitriding", by Horace C. Knerr, Metlab Co.

5:00—6:00 p.m.

Cocktail Party Sponsored by Metlab Co.

7:00 p.m.

Banquet, Harry Huester, Presiding.

"New Horizons in Metals Engineering", by Donald S. Clark.

Wednesday, May 8

9:00—11:30 a.m.

Technical Session, Stephen M. Bowes, Chairman.

"New Horizons in the Welding of Pressure Vessels for Nuclear Reactors", by R. E. Lorentz, Jr., Combustion Engineering Co.

"New Horizons in Reactor Coolants", by E. E. Hoffman, Oak Ridge National Laboratories.

"New Horizons for Sheet Metal in Supersonic Aircraft", by Richard Ahearn, Lockheed Aircraft.

"New Horizons in Titanium—a Growing Giant of Light Metals", by F. W. Drosten, Cramet Inc.

12:00—2:00 p.m.

Luncheon at Officers Club, Naval Air Station, Chet Shira, Presiding.

"New Horizons for Engineers", by George Black, The George Black Co.

2:00—4:30 p.m.

Tour of the Naval Air Station, Overhaul and Repart Dept.

A ladies program, still in the formative stage, will include a boat trip of the St. Johns River and a visit to St. Augustine.

Engineering Conference To Be Held at Ohio State

The fourth annual conference for Engineers and Architects, sponsored by the College of Engineering at Ohio State University, is scheduled for Friday, May 3, on the Ohio State campus.

Philip Sporn, president of the American Gas and Electric Service Corp., will be the keynote speaker at the general session. Dr. Sporn, a distinguished engineer, executive and administrator, is a pioneer in the advancement of practices in electric-power generation, transmission and distribution, including the applications of nuclear energy.

Luncheon session speaker will be Emanuel R. Piore, director of research for the International Business Machines Corp. and outstanding physicist and research administrator. He was formerly chief scientist for the Office of Naval Research.

The conference is expected to attract about 1000 engineers and architects from all over the country, surpassing last year's attendance of more than 800 from 21 states. Registration and the general session will take place in the University's new Mershon Auditorium, with the luncheon session to follow at the Ohio Union. The afternoon will be devoted to technical sessions in the various departments of the College of Engineering and will be followed by alumni get-togethers.

High School Day and Engineering Open House from 4:00 to 9:30 p.m. will end the day's activities.

Objectives of the conference are to "bring alumni, faculty and students of the College of Engineering together with engineers from industries in order to strengthen the mutual relationship of these groups", and "provide a medium of continued education for engineers".

Penn State's Priestley Lectures To Be Presented By Dr. John Chipman

The Priestley Lectures at The Pennsylvania State University are to be given this year by John Chipman, professor and head of the department of metallurgy at Massachusetts Institute of Technology. This is the 31st year of the lectures, which are sponsored by Mu Chapter of Phi Lambda Upsilon, honorary chemistry fraternity, in memorial to Joseph Priestley. This year's series of five lectures will be given in the Mineral Sciences Auditorium at Penn State on succeeding days, commencing Monday, Apr. 1. Dr. Chipman's general topic will be "Chemistry in the Metallurgy of Iron and Steel". His five lectures are entitled:

1. Oxidation and Reduction in Molten Iron
2. Henry's Law in Metals
3. Metallurgical Slags
4. Hydrogen in Steelmaking
5. Dephlogisticated Air in the Steel Industry.

It is expected that the lectures will attract people from a wide area. Dr. Chipman, past president A.S.M., has received many honors and is known as an excellent speaker. At the conclusion of the series, the collected lectures will be published as a single volume at a price of $2.50. Advance orders should be sent to Phi Lambda Upsilon, Dept. of Chemistry, The Pennsylvania State University, University Park, Pa., with payment enclosed. (Checks should be payable to Phi Lambda Upsilon.)

At Joint Societies Meeting in Jacksonville

R. A. Schatzel, President of the American Society for Testing Materials and Vice-President and Director of Engineering, Rome Cable Corp., Spoke on the "Fascinating Story of Insulated Wire and Cable", A. O. Schaefer, Past President A.S.M. and President, Pencoyd Steel & Forge Corp., Explained "Brittle Failure of Metals", and Robert J. Painter, Executive Secretary, A.S.T.M., Presented a Talk, "Cooperation Is Essential in Research and Standards Work in Material", at a Joint Meeting of All Technical and Professional Societies in the Jacksonville Area. Present were, seated, from left: C. S. Shira, chairman A.S.M.; Ed Van Wagenen, Florida Engineering Society; H. J. Huester, meeting chairman; Mr. Schaefer; Dr. Schatzel; Bill L. Bryant, Florida Engineering Society; A. D. Fryer, American Institute Industrial Engineers; and Mr. Painter. Standing, from left: Stanley Worth, A.I.E.E.; Jess Jackson, A.S.M.E.; Doug Hampton, A.S.M.E.; Stephen Bowes, Jr., A.S.M.; W. Tiffin, University of Florida; Walter Morris, A.S.M.; Paul E. Lindh, Jacksonville University; George Black, A.S.M.: Dan McNeil, F.E.S.; Walter Van Wagenen, F.E.S.; Tom Bostwick, N. A. C. E.: Charles Whidden, University of Florida; J. P. Hancock, N.A.C.E.; Joe Campbell; B. Boisvert and John L. Carswell, A.S.M.

Corrosion of Steel Topic at Rochester

Speaker: W. L. Mathay

U. S. Steel Corp.

W. L. Mathay, a technologist at the Applied Research Laboratory, U.S. Steel Corp., addressed the **Rochester Chapter** on "Corrosion of Steels" at a joint meeting with the Rochester Chapter of the National Association of Corrosion Engineers.

Mr. Mathay summarized the corrosion behavior and application of plain carbon, low carbon and stainless steels in various media, and illustrated the importance corrosion plays in industry. Since steel is one of the most economical construction materials, the cost of materials more resistant than steel to corrosive attack and of protective coatings for corrosion resistance should be considered as corrosion costs. It has been calculated that the annual United States direct loss by corrosion can be represented by a figure of about $5½ billion.

In atmsopheric corrosion, as with any type of corrosion, the three factors that should be considered are the metal, the environment and any barrier interposed between the metal and the environment. In some environments copper steels have twice the corrosion resistance, and high-strength low alloy steels have five times the corrosion resistance of carbon steels. When over 13% chromium is present in steel, high resistance to atmospheric corrosion results, as evidenced by the use of stainless steels in the architectural and automotive fields.

In aqueous solutions, oxygen has a very important effect on the corrosion of steel. As the oxygen concentration increases, the corrosion rate increases. The opposite is true with stainless steels where oxygen, such as in air, or oxidizing media, improve the corrosion resistance. However, the performance of stainless steels may be seriously affected by the presence of even small amounts of chlorides. Pitting corrosion and stress-corrosion cracking of the stainless steels may result if chlorides are present.

In nonoxidizing acids, such as hydrochloric and dilute sulphuric acids, the corrosion rates of steels may be high. In some oxidizing acids, such as chromic acid, a passive film is formed and steel will exhibit satisfactory resistance. The stainless steels exhibit wider corrosion resistance in oxidizing media. For example, some of the stainless steels are resistant to nitric acid at almost all concentrations and temperatures up to the boiling point.

Steels, like other metals, are susceptible to stress corrosion cracking in several media. Factors that reduce incidence of stress corrosion are: (1) a design which minimizes thermal or mechanical stresses; (2) stress-relief annealing by heating to 1100 to 1400° F. for carbon steel, and 1650 to 1750° F. for stainless steel, both followed by slow cooling. (For the austenitic steels, only the stabilized or extra low carbon grade should be so treated; otherwise, susceptibility to intergranular corrosion can be developed); (3) use of AISI Type 316 or 317 stainless steels; and (4) development of compressive surface stresses by peening or shot blasting.

Mr. Mathay pointed out that good design is probably one of the most fruitful methods of combatting corrosion. Some of the factors that can cause premature failure are turbulence, impingement, local heating, stagnant areas, crevices and stress concentrations.

Of timely interest was information about the U.S. Steel's completely austenitic, nickel-free stainless steel, USS Tenelon. Although the testing program is not complete, it is believed that the corrosion resistance of USS Tenelon is equal to or somewhat better than AISI Type 430 in severe service. USS Tenelon stainless steel appears to be eminently suited for applications involving high strength-weight ratios.—**Reported by R. E. Avery for Rochester.**

A.S.M. owns and operates the National Metal Exposition, the largest annual industrial exposition in America.

MEN OF METAL

Walter E. Kingston will become executive vice-president of Sylvania-Corning Nuclear Corp. upon its formation in the near future. He is now general manager of Sylvania's Atomic Energy Division.

Frank W. Hurd has been appointed director of research of Union Carbide Nuclear Co., a Division of Union Carbide and Carbon Corp. He has been superintendent of research and development, industrial applications, for Union Carbide Nuclear Co. since 1955.

Earl A. Neeb, formerly general superintendent of hot rolling and slab conditioning at the Brackenridge Works, Allegheny Ludlum Steel Corp., has been appointed plant manager of the Toronto, Ohio, plant of the Titanium Metals Corp. of America, which is being reconstructed to forge titanium billets and roll titanium alloy sheet.

Osgood J. Whittemore, Jr., has been appointed chief ceramic engineer of Norton Co.'s Refractories Division. He will be responsible for manufacturing control and process engineering activities on all products made by the Division.

Harold M. McCullough has joined the research and development department as research associate of the Universal-Cyclops Steel Corp. He was previously employed with Sylvania Electric Products Inc.

P. J. Hughes was recently appointed assistant to the works manager at Midvale-Heppenstall Co. Mr. Hughes was associated in the making and forging of steel with Midvale for six years, and was associated with consulting engineers in the layout and construction of steel plants manufacturing forgings for commercial and ordnance products. He joined Midvale-Heppenstall in 1956.

Lester-Phoenix, Inc., has announced the appointment of Ray Neubecker as its representative in California. Mr. Neubecker has a background of. 15 years in the plastics and die casting industry.

Edwin T. Goodridge has resigned as president of Horizons Inc. to devote his full time to other business. He is being retained by Horizons in a consulting capacity. K. M. Bartlett, former executive vice-president, will take over as president.

Edmund S. Davenport, assistant to vice-president, research and technology, U. S. Steel Corp., delivered the Howe Memorial Lecture at the annual meeting of A.I.M.E. He spoke on "Some Observations on Ferrite-Carbide Aggregates in Alloy Steels".

Elton E. Staples, executive vice-president of Hevi-Duty Electric Co., has been appointed chairman of the public relations committee of the Industrial Heating Equipment Association. He will preside over the Symposium on Brazing and Sintering to be held on Mar. 26 at the Western Metal Congress in Los Angeles.

Charles D. Coxe has been appointed manager, metallurgical department, for Handy & Harman. He became affiliated with Handy & Harman in 1946 as chief metallurgist in the technical laboratory.

Earl G. Olsen, sales engineer and technical consultant, has been made manager of the newly formed sales offices in Rochester, N. Y., for Lindberg Engineering Co.

Edward M. Grady has been appointed assistant to the vice-president of sales for the Western Brass Mills Division of Olin Mathieson Chemical Corp. Prior to this change he had been assistant sales manager of mill products.

Vacuum Die Casting of Aluminum and Zinc Topic At Meeting in Calumet

Speaker: Dave Morganstern

Nelmor Manufacturing Corp.

Members attending the nonferrous meeting of the **Calumet Chapter** heard Dave Morganstern, vice-president, Nelmor Manufacturing Corp., speak on "Vacuum Die Casting of Aluminum and Zinc".

Because of the preponderance of ferrous men in the audience, Mr. Morgenstern opened by giving a description of die casting in general. The most common methods now in use are the hot chamber and cold chamber processes. The first method, used for making low-melting zinc castings, is much the faster of the two but is not suitable for forming the higher melting more reactive aluminum alloys since the chamber must be immersed in the molten hot metal from the pot to the chamber for each shot. This step is not only time consuming, but, in addition, causes a considerable drop in temperature, thereby increasing the difficulty of filling out the intricacies of the die and producing a sound surface. To counteract the sluggishness of the aluminum alloys, it is necessary to add as much as 12% silicon to the alloy. While this addition is effective in producing a fluid metal, its presence has the disadvantage of prohibiting the use of final anodizing treatments on the finished castings.

Vacuum die casting, as used at Nelmor, circumvents these difficulties by eliminating most of the air from both the chamber and the die. Evacuation is carried out very rapidly by means of an accumulator system which is sufficiently strong to pull molten metal from the pot into the chamber through a refractory tube, thus eliminating ladling. Since little air is present in the die, bubble entrapment and oxidation products are absent, the need for strategic vent placement is unnecessary, and the power needed for the shop is reduced by at least 50%.

Because the physical properties of zinc die castings are largely dependent on the density and thickness of the fast-setting skin, the increases resulting from vacuum casting have opened up new fields to the industry. Removal of air, and hence porosity, has resulted in castings which can be depended upon to give day-to-day strengths of 42,000 psi. as compared to the expected variation of from 20,000 to 42,000 psi. existing in castings made without vacuum. This dependability enables the designer to make drastic over-all reductions in metal thicknesses without fear of under-designing. All types of final finishing operations, including anodizing on aluminum low-silicon casting, can be used, and the uniformity of electroplate is better than ever before attained.

With the present-day demands for anodized aluminum, it is expected that the use of the vacuum process will show a marked increase, especially since these vacuum conversion units can be applied directly to the standard machines now in use for the production of anodizable castings using low-silicon alloys heretofore not practical to die cast.—**Reported by J. W. Luoma for Calumet.**

Speaks on Cold Heading At Meeting in Hartford

Speaker: Joseph Cogan

National Machinery Co.

Members of the **Hartford Chapter** recently heard a talk on "Cold Heading" by Joseph Cogan, National Machinery Co.

A movie, "Automatic Cold Heading", which showed close-ups and slow-motion shots of various cold heading operations, was presented. One of the principal points brought up in the discussion period following the movie was the heating of stock in the range from 400 to 900° F. for warm heading. Mr. Cogan stated that this was a very "hot" item in the cold heading picture, but, at present, there is very little information on it except that it seems to have great possibilities. — **Reported by T. P. Hanford for Hartford.**

Outlines Modern Quenching Techniques

Orville E. Cullen, Chief Metallurgist, Surface Combustion Co., Is Shown With a Group of Chicago-Western Members Following His Talk on "Modern Quenching Techniques". From left: A. F. Koctur, chairman; Mr. Cullen; N. K. Koebel, technical chairman; and P. P. Burns, program committee

Speaker: O. E. Cullen
Surface Combustion Corp.

Orville E. Cullen, chief metallurgist, Surface Combustion Corp., presented a talk on "Modern Quenching Techniques" before a recent meeting of the **Chicago-Western Chapter.**

When only plain carbon steels were used, the problem of quenching was elementary: The part either hardened, or it didn't. Many parts containing high levels of residual stress often caused service failures. High degrees of distortion during the quench caused straightening to be a major factor of expense.

Quenching today plays an integral role in the production of a finished heat treated part, especially with the advent of "automation" in mass production. A successfull highly stressed part, in addition to good design, must have uniformly high quality in steel manufacturing, forging, machining, heating, quenching and tempering.

The choice of the quenchant is the basic problem in the quenching process. Some steels can harden effectively in air, others in oil, some in water, and others only in brine. The quenchants vary greatly in the manner in which they affect the vapor arising from the surface of the hot part. Since the vapor acts as a blanket, or insulator, it must be prevented from forming by proper choice of quenchant or removed by rapid relative motion or agitation between the part and the quenchant.

The degree of agitation of the quenchant can have a profound effect on the effective hardenability of a given steel in a particular quenchant since it determines the rate of heat removal from the surface and from the interior, since the heat must escape through the surface. Agitation is becoming increasingly important with the use of higher quenching temperatures.

Use of hot quenching is increasing greatly because of the need to minimize residual stresses and resulting distortion in close tolerance parts such as gears, tools, dies, and other fixtures. Marquenching, one of the most successful techniques, permits elimination of internal temperature gradients near the start of martensite formation. Subsequent air cooling to room temperature results in relatively little residual stress development even though the part has about the same microstructure as if it had been direct quenched. In this type of delayed quench it is necessary to get the part down past the nose of the isothermal transformation curve before any high-temperature products form. The use of special oils at temperatures above about 450° F. presents problems inherent with all oils, however.

In general, the higher the oil temperature, the shorter its life. Oxidation and other chemical deterioration of quenching oil at high temperatures tends to limit its life unless steps to prevent this breakdown are taken. When quenching oil viscosity increases with use, its quenching power tends to diminish. Additives often appear to extend the useful period. A practical means of minimizing oxidation at higher temperatures is to have the furnace designed so that the quench is hooded. In this way only the reducing furnace atmosphere comes in contact with the oil. This also prevents decarburization and scaling of the part since it does not encounter air while hot. In cases where hot oil quenching is not practical, another means of minimizing distortion may be employed, such as suitable fixturing and quench tank design.

Die quenching holds the parts stationary by mechanical means such as presses or other fixtures. Distortion is minimized because of the restraints imposed by the equipment which may be designed to accommodate several similar parts simultaneously. This is in line with the modern concept of production-line heat treating. Careful control of the factors of the quenchant itself, its agitation, its temperature, and its useful life tend to produce uniform quality in the finished product.—**Reported by M. F. Surls for Chicago-Western.**

To Receive Penn State's David McFarland Award

The **Penn State Chapter** has selected Elwood D. Mairs, works manager of the Alcoa extrusion and tubing plant, Lafayette, Ind, as the 1957 recipient of the David Ford McFarland Award for Achievement in Metallurgy.

Mr. Mairs, a native of Bridgeport, Pa., graduated from Pennsylvania State University in 1926, after attending Norristown High School and Mercersburg Academy. He will return to his alma mater on Apr. 26 to receive the award at a dinner meeting of the Penn State Chapter.

E. D. Mairs

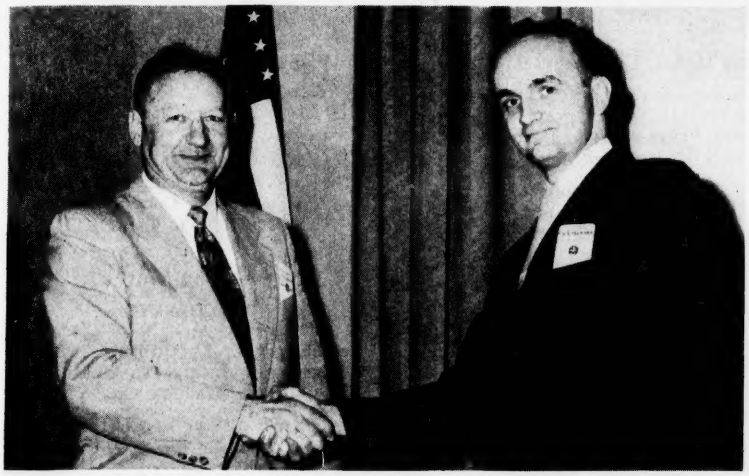
After graduation from Penn State, Mr. Mairs was employed by Alcoa at New Kensington, Pa., but was transferred early in 1927 to Massena, N. Y. Here he rose steadily, becoming assistant works manager in 1945. In 1949 he was transferred to Vancouver, Wash., where he organized and managed the Alcoa fabricating division. In 1956 he took over as works manager of the Alcoa extrusion and tube mills in Lafayette, Ind.

Mr. Mairs has been active in the service clubs and fraternal organizations of the communities in which he has lived. This fact is significant, amongst others, in his selection as the 1957 awardee, for the committee takes into account not only the technical accomplishments but community services as well in making its selections.

The McFarland Award was established by the Penn State Chapter as an annual recognition to a metallurgy alumnus of the University.

A. S. M. has produced and makes available for showing before chapters and educational institutions moving picture films pertaining to metals.

Discusses Metallurgy of Uranium



Cincinnati Past Chairman, Fred Westermann, Is Shown Introducing the Speaker, Harley A. Wilhelm, National Trustee A.S.M., During the Past Chairmen and National Officers Night Meeting Held by the Cincinnati Chapter. Dr. Wilhelm presented a talk entitled "Metallurgy of Uranium"

Speaker: Harley A. Wilhelm
Iowa State College

Harley A. Wilhelm, associate director of the Ames Laboratory of the A.E.C. and trustee A.S.M., addressed the **Cincinnati Chapter** in a dual capacity. As the coffee speaker he outlined and reported progress on the present and future plans and developments of A.S.M. In addition he presented a history of the manufacture, fabrication and use of uranium metal from the time the atomic energy program was organized on Dec. 6, 1941, the day before Pearl Harbor. His talk was entitled "Metallurgy of Uranium".

The atomic energy program, as originally outlined, called for dual lines of approach to the problem of obtaining fissionable material — one line involving the concentration of U_{235} and the other involving production of Pu_{239}. For the production of the plutonium, many tons of pure uranium metal were required. At that time there were two methods of producing uranium metal in operation on a small scale in the United States. One was by the chemical process employing calcium hydride and uranium dioxide, which yielded powdered uranium that was usually contaminated with considerable residual oxide. The other process involved the electrolytic deposition of uranium from potassium uranium fluoride in a fused salt bath. This process likewise produced a powdered or granular metal.

Dr. Wilhelm pointed out that in 1941 even such physical constants of uranium as its melting point were not accurately known. It was found that the heat of reaction of a mixture of uranium tetrafluoride and calcium was sufficient to result in metallic uranium and calcium fluoride, both in the fused state; this allowed these products to separate as slag and metal. Production of uranium by this reaction was started in 1942 and two tons of metal were thus supplied for the first atomic reactor.

It was also found that magnesium in combination with uranium tetrafluoride, when preheated, would yield metal in a similar manner. This discovery led to the development of the bomb process by which the uranium tetrafluoride and magnesium are fired in a steel shell lined with a refractory to produce a high-grade uranium metal. More than 1000 tons of uranium metal ingots were produced on the college campus before the process was turned over entirely to industry. This is the process used by the United States today to provide the uranium metal for the atomic energy plants producing fissionable Pu_{239}.

Dr. Wilhelm also mentioned some of the problems involved in the fabrication of uranium metal that are due to the different lattice structures of the various phases. He pointed out that from room temperature to 660° C., the alpha phase, orthorhombic with 4 atoms/unit cell, exists. From 660 to 770° C., the beta phase, tetragonal with 30 atoms/unit cell, exists. From 770° C. to the melting point (1130° C.), the body-centered cubic gamma phase exists with 2 atoms/unit cell.

Thermal cycling within the alpha range may cause growth as illustrated by the fact that a rolled bar of metal increased to six times its original length upon heating and cooling for 3000 cycles in the alpha range.

Annealing in the beta range greatly reduces this growth tendency; however, uranium in this range is very brittle. Therefore, most of the rolling and extrusion operations are carried out in the alpha or gamma range.

In closing, Dr. Wilhelm mentioned briefly some of the end uses of uranium metal. In these uses corrosion problems are of considerable significance since uranium has very poor corrosion resistance.—**Reported by J. H. Timmers for Cincinnati.**

Rockford Chapter Entertains Ladies

Shown Is Part of the Crowd of 42 Members and Wives Who Attended the Annual Ladies Night Meeting in Rockford. After the dinner meeting, D. A. Campbell, chairman, presented a review of the activities of A.S.M. and presented a past-chairman's certificate to Gordon Engles, which was accepted by Jay Sturm in his absence. Entertainment completed the evening

Titanium Conference — Western Metal Congress

Ambassador Hotel, Los Angeles, March 25-29, 1957

Registrants from 19 states, two Canadian provinces, and several foreign countries are already enrolled for the 5-day Conference on Titanium scheduled for Mar. 25-29, inclusive, at the Ambassador Hotel in Los Angeles. The list of lecturers comprises a formidable array of "know-how" in titanium technology and fabrication. Emphasis will be placed on design criteria, fabrication techniques, machining, joining, and other developments in shaping titanium.

The size of the conference will be restricted to promote an atmosphere of informality in order to encourage freedom of expression and discussion. Participation in the conference can be assured by advance registration. (Use the convenient coupon on p. 79).

Several requests have been received for information regarding the purchase of available reprints. Companies that find it impossible to send representatives to the conference will be able to obtain a file of the lectures (a few will not be reprinted) by writing to ASM headquarters.

Monday, Mar. 25

Presiding: Walter L. Finlay, Vice-President, Rem-Cru Titanium, Inc., Midland, Pa.

8:00 a.m. **Registration:** (Also Sunday evening)

9:00 a.m. **Welcome:** Donald S. Clark, President A.S.M., California Institute of Technology

9:15 a.m. **Titanium Progress to Date** by Harry B. Goodwin, Battelle Memorial Institute, Titanium Metallurgical Laboratory, Columbus, Ohio

10:00 a.m. **Today's Uses and Design Criteria**

In Piloted Airframes, by S. R. Carpenter, Supervisor, Producibility, Convair, San Diego, Calif.

In Missiles, by A. T. Mocium, Section Head, Missile Development Division, North American Aviation, Inc., Downey, Calif.

In Turbo-Jet Engines, by A. W. F. Green, Technical Assistant to Executive Engineer, Allison Division, General Motors Corp., Indianapolis, Ind.

In Pratt & Whitney J-57 Jet Engine, by W. H. Sharp, Metallurgical Engineer, Pratt & Whitney Aircraft, East Hartford, Conn.

In Army and Navy Applications, by A. F. Jones, Chief, Materials Utilization Division, Ordnance Materials Research Office, Watertown Arsenal, Watertown, Mass.

In Civilian Applications, by L. J. Barron, Specialty Products Section, Pigments Dept., E. I. du Pont de Nemours & Co., Wilmington, Del.

12:30 p.m. **Group Luncheon**

2:00 p.m. **Titanium Riveted Fasteners,** by Harry Brenner, Director of Engineering, Olympic Screw & Rivet Corp., Downey, Calif.

2:30 p.m. **Practicability of Titanium Alloy Bolts,** by J. A. Van Hamersveld, General Supervisor, Producibility Engineering, Northrop Aircraft, Inc., Hawthorne, Calif.

3:15 p.m. **Pickling, Degreasing and Abrasive Cleaning,** by Walter H. Bishop, Chief Process Engineer, Mallory-Sharon Titanium Corp., Niles, Ohio

4:00 p.m. **Salt Bath Descaling,** by Walter H. Bishop, Mallory-Sharon Titanium Corp., Niles, Ohio

Tuesday, Mar. 26

Presiding: John H. Garrett, Executive Secretary, Coordinating Committee on Materials, Office of Assistant Secretary of Defense

9:00 a.m. **Blanking and Sheet Metal Forming,** by W. A. Mays, Group Leader, Metallurgical Products Development Laboratory, and G. J. Matey, Special Tool Engineer, North American Aviation, Inc., Los Angeles

10:30 a.m. **Forming of Extrusions and Bars,** by G. A. Moudry, Harvey Machine Co., Torrance, Calif.

11:00 a.m. **Stretch and Compression Forming,** by Cyril Bath, President, or F. J. Phillips, Sales Manager, Cyril Bath Co., Solon, Ohio

11:40 a.m. **Stress Relief, Annealing, Reactions With Atmosphere,** by Daniel J. Maykuth, Assistant Chief, Nonferrous Physical Metallurgy Division, Battelle Memorial Institute, Columbus, Ohio

12:30 p.m. **Group Luncheon**

2:00 p.m. **Panel on Forming**

Moderator: August Bringewald, Project Manager, Republic Aviation, Long Island, N. Y.

Panel Members: W. A. Mays, G. J. Matey, G. A. Moudry, Irvin Wilson, Cyril Bath, H. O. Mattes, Field Metallurgist, Republic Steel, Canton, Ohio, and L. A. Best, Douglas Aircraft, Santa Monica, Calif.

Wednesday, Mar. 27

MACHINING

Presiding: E. J. Krabacher, Senior Research Engineer, Cincinnati Milling Machine Co.

9:00 a.m. **Milling and Contour Cutting,** by Gordon C. Campbell, Chief, Manufacturing Research Section, Boeing Airplane Co., Seattle, Wash.

10:00 a.m. **Drilling and Reaming,** by F. A. Reed, Staff Superintendent, Aviation Gas Turbine Division, Westinghouse Electric Corp., Kansas City, Mo.

11:00 a.m. **Single Point Cutting,** by S. H. Flanagan, Convair, San Diego, Calif.

12:00 noon. **Grinding of Titanium,** by L. C. Hays, Staff Industrial Engineer, Thompson Products Co., Cleveland, Ohio

12:30 p.m. **Group Luncheon**

2:00 p.m. **Chem-Mill Process,** by Manuel C. Sanz, Chief, Materials Research, Missile Development Division, North American Aviation, Inc., Downey, Calif.

2:30 p.m. **Panel on Machining**

Moderator: E. J. Krabacher, Senior Research Engineer, Cincinnati Milling Machine Co.

Panel Members: L. B. Stearns, Chief Engineer, U. S. Chemical Milling Corp., Manhattan Beach, Calif., Dillon Evers, Associate Director of Research, Mallory-Sharon, Niles, Ohio, G. C. Campbell, F. A. Reed, S. H. Flanagan, L. C. Hays, and M. C. Sanz

Thursday, Mar. 28

WELDING AND BRAZING

Presiding: E. W. Cawthorne, West Coast Representative, Titanium Metallurgical Lab., BMI, Downey, Calif.

9:00 a.m. **Arc Welding Titanium,** by Glenn Faulkner, Assistant Chief, Metals Joining Division, Battelle Memorial Institute, Columbus, Ohio

10:00 a.m. **Flash Welding,** by R. D. Libert, Supervisor, Research and Development, Aeronautical Division, A. O. Smith Co., Milwaukee, Wis.

11:00 a.m. **Brazing and Soldering,** by Harry Schwartzbart, Supervisor, Welding Research, Armour Research Foundation, Chicago, Ill.

11:45 a.m. **Influence of Impurities,** by D. H. Barbour, Assistant Manager, Products and Process Development Dept., Electro Metallurgical Co., Niagara Falls, N. Y.

12:30 p.m. **Group Luncheon**

2:00 p.m. **Los Angeles Chapter A.S.M. Panel on Titanium.**

Friday, Mar. 29

A LOOK INTO THE FUTURE

Presiding: Leo Schapiro, Douglas Aircraft Co., Santa Monica, Calif.

9:00 a.m. **Present Limitations and Future Potentials of Titanium Castings,** by A. H. Roberson, U. S. Bureau of Mines, Albany, Ore.

9:45 a.m. **Present Limitations and Future Potentials of Titanium Powder Metallurgy,** by A. D. Schwope, Manager, Materials Division, Clevite Research Center, Cleveland, Ohio

10:45 a.m. **Present Limitations and Future Potentials of Titanium Forgings,** by J. J. Russ, Technical Director, Steel Improvement and Forge Co., Cleveland, Ohio

11:30 a.m. **Present Status and Future Potential of Titanium Tubing,** by T. M. Krebs, Metallurgist, Babcock & Wilcox Co., Tubular Products Division, Beaver Falls, Pa.

12:30 p.m. **Group Luncheon**

2:00 p.m. **Integrated Sheet Rolling Program,** by N. E. Promisel, Chief Metallurgist, Navy Dept., Bureau of Aeronautics, Washington, D. C.

2:30 p.m. **Producers' Research and Development Programs,** by Lee S. Busch, Director of Research, Mallory-Sharon, Niles, Ohio, H. D. Kessler, Supervisor, Metallurgical Research Division, TMCA, Henderson, Nev., W. L. Finlay, Vice-President, Rem-Cru Titanium, Midland, Pa., and S. W. Poole, Director, Titanium Research, Republic Steel Corp., Canton, Ohio.

4:15 p.m. **Outlook for Titanium in the Aircraft Industry,** by T. H. Gray, Assistant Chief Metallurgist, Boeing Airplane Co., Seattle, Wash.

4:45 p.m. **Closing Remarks,** by W. H. Eisenman, National Secretary A.S.M.

Announce Changes on Metals Progress Staff

John B. Verrier, Jr., who has represented *Metal Progress* since 1951, has been appointed regional manager for the publication, with headquarters at 342 Madison Ave., New York. John will have over-all responsibility for the eastern territory, extending throughout New York and New England.

John, who received a degree in mechanical engineering from Cornell University in 1935, will continue to serve industry on all technical, market and product sales problems connected with manufacturing, plant equipment and product distribution.

J. B. Verrier, Jr.

He was formerly application engineer for Norma Hoffman Bearings Corp., assistant sales manager for Wilson Mechanical Instrument Co., and assistant to president, C. B. Dolge Co. He is married and lives with his wife and three children in Greenwich, Conn.

Victor D. Spatafora has been appointed manager of the Chicago district for *Metal Progress.* Vic is a native of Illinois and attended De-Paul University and North Park College from 1949 to 1952. In 1955 he received a B.S. degree in marketing at Roosevelt University. Immediately after graduation, he joined the staff of the Haywood Publishing Co. where he received a 4-month intensive training program in the graphic arts.

In January 1956 Vic was assigned to the Cleveland office of *Electrical Dealer,* representing the publication in most of Ohio and the southern part of Michigan. In August 1956 he joined the sales staff of Hines Lumber Co., remaining there until his appointment to *Metal Progress.* Vic is married and has one son.

Fred Stanley has been appointed district manager for *Metal Progress* for the New York and Philadelphia areas. He is a native New Yorker and a graduate of Holy Cross College with a B.S. degree in business administration. Since 1948 he has represented space sales for *Instruments, Journal of Metals* and *Automation.*

Automotive Metallurgy Is Topic at Ottawa Valley

Speaker: W. R. Moggridge
Ford of Canada

W. R. Moggridge, chief inspector of foundry and heat treat plant, Ford of Canada, presented a talk at a meeting of the **Ottawa Valley Chapter** on "Automotive Metallurgy".

Mr. Moggridge began his talk by quoting some impressive statistics which indicated the large quantities of metals which are consumed by the automotive industry. At Windsor alone, as much as 450 tons, produced by arc and cupola furnaces, has been used in one day for the production of automotive components.

Shell molding, which has recently been adopted, was discussed. Cold blast, water-cooled cupolas, without lining, were installed to produce the nodular iron which is used in many of the shell cast components, such as crankshafts. All steel scrap is used for the charge.

Certain economies have been made possible by adopting shell molding, such as reduction of machining costs and reduction of rejects. A new resin-coated sand which is now used in the shell molding process has been mainly responsible for its increased efficiency.

Many castings, such as cylinder heads, fly wheels and camshafts, are still made by the green sand molding process.

Statistical control has been adopted extensively for the control of such green sand properties as moisture, permeability and green strength. This method of control has also been found valuable where pattern changes are desired to reduce machining costs, and in this capacity often helps promote sounder vendor-consumer relationships.

With reference to the future of metallurgy in the automotive industry, the speaker mentioned the probability that many items now forged will some day be cast. This would result mainly from the attainment of closer dimensional tolerances, fewer rejects and lower machining costs for castings. Cold forming certain components from bar stock is another practice suggested for future consideration. Also, conservation of metals and reduction of costs might be effected by replacing copper with copper or brass-clad steel in radiators, and by aluminizing exhaust valves.—**Reported by R. D. McDonald for Ottawa Valley.**

A.S.M. created the Annual Teaching Award in Metallurgy, open to teachers of metallurgy in the United States and Canada. Value $2000.

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad Received During the Past Month

Prepared at the Center for Documentation and Communication Research, Western Reserve University, Cleveland, With the Cooperation of the John Crerar Library, Chicago.

Annotations carrying the designation (CMA) following the reference are published also in *Crerar Metals Abstracts*.

A General Metallurgy

70-A. What's Ahead in Steel Research? E. C. Bain, *Chemical and Engineering News,* v. 35, Feb. 4, 1957, p. 26.

Use of oxygen for metallurgical refining, direct reduction of iron ore and high-strength alloys are mentioned.
(A9, D8j, D10; ST, SGB-a)

71-A. Casting Design. A Teaching Method. L. B. Zylstra and W. A. Snyder. *Foundry,* v. 85, Feb. 1957, p. 126-129.

Course for engineering students at University of Washington demonstrates the importance of design in facilitating manufacture.
(A3, E general, 17-1)

72-A. Some Metallurgical Advances: How and Why They Occurred. Werner Koster. *Institute of Metals, Journal,* v. 85, Dec. 1956, p. 113-118.

Advances in the field of metallurgy: age-hardening alloys, stainless steels, permanent-magnet alloys; varied ways in which discoveries may come about; future of metallurgy as an independent of science. 22 ref. (A general)

73-A. Let Aluminized Suits Speed Openhearth Repairs. *Iron Age,* v. 179, Jan. 24, 1957, p. 86.

Aluminized asbestos clothing shortens waiting period for cooling openhearth. (A7p, D2, 18-22)

74-A. The Prevention of Gas. Thomas A. Watson. *Iron and Steel Engineer,* v. 34, Jan. 1957, p. 82-88.

Characteristics and effects of gases most commonly found in steel plants. Organization, equipment, procedures, precautions to be observed in and around boiler house, opening blast furnace gas, gas engines, gas power engine to prevent gas accidents. (A7p; ST, RM-g)

75-A. Developments in the Iron and Steel Industry During 1956. I. E. Madsen. *Iron and Steel Engineer,* v. 34, Jan. 1957, p. 119-169.

Foreign plants, raw materials, blast furnaces, rolling, finishing, furnace controls, and material handling.
(A general, D general, F general; ST)

76-A. Symposium on Titanium I. Sponge and Mill Production Economics. H. H. Kellogg. *Journal of Metals,* v. 9, Jan. 1957, p. 161-166. (CMA)

Predictions are cited for future prices of titanium sponge (less than $1.40 per lb.) and mill products. A cost analysis is presented for sponge production and a number of economies which might be possible are indicated. These include increase of recovery of saleable sponge to 96%, recycling $MgCl_2$, reduction in rutile price, maintenance, research and testing, and reductions in labor force. The average price of mill products is now $13 per lb. Rather small size of orders for mill products contributes to higher costs. The main future reductions in mill product costs will come from savings in sponge processing. (A4s; Ti)

77-A. Symposium on Titanium II. Mill and Fabrication Economics. S. A. Gordon. *Journal of Metals,* v. 9, Jan. 1957, p. 167-172. (CMA)

Failure to reduce fabrication costs for titanium mill parts could easily make cost a first consideration in selecting a material. The most serious obstacle to reducing fabrication costs appears to have been the lack of a consistent fabrication technology by the aircraft builders. Uniformity of the material should remove this obstacle. Comparison is made with aluminum fabrication for aircraft. (A4s, F general; Ti)

78-A. Symposium on Titanium IV. Practical Problems Associated With the Control of Interstitials III. Shop Practice for Control of Interstitials. H. Brown. *Journal of Metals,* v. 9, Jan. 1957, p. 182-184. (CMA)

Cleaning, forming, descaling, welding and heat treatment of titanium are recommended for shop practice. General contamination control requires the minimum number of operations and an aluminum coat for forging operations or hot forming; the coat is removable by pickling. Deviations from established practice will probably be expensive.
(A general, 18, 3-19; Ti)

The subject coding at the end of the annotations refers to the revised edition of the ASM-SLA Metallurgical Literature Classification. The revision is currently being completed by the A.S.M. Committee on Literature Classification, and will be published in full in late spring or early summer. A schedule of the principal headings in the revised version was published in the February issue.

79-A. Development of the Aluminum Industry in Austria. Eduard Nachtigall. *Metal Progress,* v. 71, Jan. 1957, p. 77-81.

Now that Austria has regained control of her aluminum industry, several special products for consumers have been devised, including siding and roofing, snow fences, electrical conductors, nails and deep drawing sheet. (A4p, T general; Al)

80-A. Classification of Titanium Alloys. T. W. Lippert. *Metal Progress,* v. 71, Jan. 1957, p. 112-B. (CMA)

Current systems for identifying titanium alloys are based either on alloying additions or on tensile or yield strength values. A nomenclature is proposed which first identifies the alloy as titanium-base by use of the letter T. Five digits follow: the first indicated what principal kind (if any) β addition has been made, the second the total percentage of β addition, the third the total percentage of aluminum, tin and/or zirconium, and the fourth and fifth the oxygen percentage plus twice the nitrogen percentage expressed in hundredths.
(A general; Ti, 15-11)

81-A. Service and Maintenance Forum on Technical Progress. *Steel,* v. 140, Jan. 7, 1957, p. 419-428.

Sixteen executives briefly state present trends and problems. A few of these are: adequate air movement and ventilation, tighter management of water, cathodic protection for industrial piping.
(A general, 18-21)

82-A. Automatic Scrap Disposal. *Tooling and Production,* v. 22, Jan. 1957, p. 149.

High tonnage press unit for automobile makers. (A8d; RM-p)

83-A. Metals Ban Lift Will Speed High Temp Alloy Research. R. H. Thielmann. *Western Metals,* v. 15, Jan. 1957, p. 68-71.

Removal of quota restrictions increases possiblities of utilizing high-temperature properties of columbium, molybdenum, tantalum and tungsten in alloys with sufficient strength, corrosion resistance and high temperature performance for jet engine applications.
(A4p, Q general, 2-12; Cb, Mo, Ta, W)

84-A. (German.) **New Developments in Nickel and Nickel Alloys.** W. Betteridge. *Metall,* v. 11, Jan. 1957, p. 24-28.

Nickel plating, special quality nickel, nickel-copper alloys, nickel-chromium alloys, high fatigue test nickel-alloys, nickel-molybdenum alloys, sinter metals. 9 ref.
(A general; Ni)

85-A. (German.) **Present State and Anticipated Development of the Iron Ore Supply.** Eugen Plotzki. *Stahl & Eisen,* v. 76, Dec. 27, 1956, p. 1728-1734.

Development of iron ore production of the world. Increase of iron ore production corresponding to production of pig iron in America. Limits of the increase of ore mining in Europe. Examples for the possibilities of the future ore supply.
(A11a, A4p; Fe, RM-n)

86-A. Metallurgical Topics. *Engineer,* v. 202, Dec. 28, 1956, p. 922-923.

Scoring and surface damage; metallurgical uses of sodium and beryllium copper.
(A general; Na, Cu, *Be*)

87-A. Improvements in Hot Rolled Grain-Oriented Transformer Sheet. A. Muhlinghaus. *Engineers Digest,* v. 17, Dec. 1956, p. 506-508. (From *Elektrotechnische Zeitschrift (ETZ),* Ausgabe A., v. 77, no. 20, Oct. 11, 1956, p. 732-736.)

Previously abstracted from original. See item 221-V, 1956.
(A general; SGA-n)

88-A. Titanium Industry Review for 1956. T. W. Lippert. *Industrial Heating,* v. 24, Jan. 1957, p. 38, 40, 44. (CMA)

Prices were cut and production increased in the titanium industry in 1956; 5300 tons of mill products were produced, with a market value of $130 million. A total of 14,500 tons of sponge was produced; the leading producer was TMCA. Two new ingot melting firms are Harvey Machine Co. and the Oregon Metallurgical Corp. Cramet merged with Republic Steel during the year. Japanese firms exported 1750 tons of sponge to the U. S. in 1956. Electrolytic winning of titanium continues to show promise, but all commercial producers use magnesium or sodium reductants.
(A4p, C general; Ti)

89-A. Foundry Dust Control. VII. E. Bradley. *Industrial Heating Engineer,* v. 18, Jan. 11, 1957, p. 359-361.

Exhaust system for belt sander and disk sander. Layout of typical small pattern shop. To be continued.
(A8a, E17, 18-17)

90-A. How to Get More for Your Metalworking Dollar. 7. Aluminum. *Iron Age,* v. 179, Jan. 31, 1957, p. 58-72.

Aluminum alloys—characteristics, heat treatment, forging, casting, grinding, forming, welding, riveting, extruding, cleaning and finishing.
(A general; Al)

91-A. German Engineering Steels and Their British Equivalents. W. B. Kemmish. *Machinery,* v. 90, Jan. 11, 1957 p. 84-89.

Comparison charts and tables of German and British steels on strength basis. Brief explanation of German designation system. Characteristics of German direct-hardening and case-hardening steels are considered. (A general, 15-5, 15-6; ST)

92-A. Machine Searching of Metallurgical Literature. Allen Kent, Robert E. Booth and J. W. Perry. *Metal Progress,* v. 71, Feb. 1957, p. 71-75.

The research project, only a year old, has already formulated a coding system adaptable to machine feed for various commercial computers and electronic selectors, and several thousand metallurgical asbstracts have already been encoded and trial runs made on equipment constructed at Western Reserve University.
(A14e)

93-A. A Dictionary of Metallurgy. A. D. Merriman and J. S. Bowden. *Metal Treatment and Drop Forging,* v. 24, Jan. 1957, p. 21-28.

From "Vicalloy" to "Welding". To be continued. (A general, 11-17)

94-A. Uranium Ores: Their Occurrence and Treatment. S. W. F. Patching. *Nuclear Power,* v. 2, Jan. 1957, p. 12-17.

Important minerals and ore types; physical methods of concentration; world distribution of uranium.
(A11a, B14; U, 14-9)

95-A. Mount Wright Gold Deposit, Ravenswood. T. H. Connah. *Queensland Government Mining Journal,* v. 57, July 20, 1956, p. 529-535.

Evaluation of the low-grade ore body at Mount Wright.
(A11a; Au, 14-9)

96-A. Carbide Metallurgy Simplified. E. V. Anderlite. *Tooling and Production,* v. 22, Feb. 1957, p. 95-98.

Analysis of the three principal groups of carbides—cast iron and nonferrous grades, steel grades, wear and die grades—from the point of view of the tool technician and the engineer. (A general; SGA-j, 6-19)

97-A. Monazite Placers on South Muddy Creek, McDowell County and Silver Creek, Burke County, North Carolina. L. A. Hansen and A. M. White. *U. S. Atomic Energy Commission RME*-3115, March 1954, 28 p. (CMA)

Areas of North Carolina were drilled and explored for monazite placers along South Muddy Creek, Silver Creek and the Catawba River. The mineral composites showed 23 and 32% ilmenite, 8 and 6% zircon, 0.5 and 2% rutile and 6.4% and 6.2% monazite, respectively, for South Muddy Creek and Silver Creek. Map included. (A11a; Ti, Zr, 14-9)

98-A. Monazite Placer at the Junction of the North Tyger River With the Middle Tyger River, Spartanburg County, South Carolina. L. A. Hansen and N. P. Cuppels. *U. S. Atomic Energy Commission, RME*-3117, Jan. 1955, 23 p. (CMA)

Flood plain placers on the Tyger Rivers were explored. The minerals were estimated in one at 6570 tons of monazite, 51,200 tons of ilmenite, 2100 tons of rutile and 13,400 tons of zircon, with the heavy mineral content averaging 9.35 lb. per cu. yd. of alluvium. (A11a; Ti, Zr)

99-A. Potential of Heavy-Mineral-Bearing Alluvial Deposits in the Pacific Northwest. A. J. Kaufman, Jr., and K. D. Baber. *U. S. Bureau of Mines, Information Circular* 7767, Dec. 1956, 36 p.

Occurrences and reserves are listed for Idaho, Montana and Washington. Titanium, hafnium, rare earth metals, thorium, columbium and tantalum are emphasized. 13 ref.
(A11a; Ti, Hf, Th, Cb, Ta, EG-g, 14-9)

100-A. Steel Mill Reclaims Process Wastes in Chemical Treatment Plant. *Wastes Engineering,* v. 28, Jan. 1957, p. 36.

Installation of equipment; coagulants for steel mill wastes.
(A8, 1-2; ST)

101-A. (Dutch.) **News of the Nickel World.** C. Vollers. *Metalen,* v. 12, Jan. 1957, p. 11-12.

International Nickel's expansion plans (385 million lb. of nickel per year in 1960) reviewed. (A4p; Ni)

102-A. (French.) **Metallurgy of Uranium.** G. Cabane. *Enérgie Nucléaire,* v. 76, Oct. 1956, p. 18-24.

Description of the properties of uranium. 52 ref.
(A general, P general, Q general; U)

103-A. (French.) **Titanium. Summary of American Experience.** *Métaux-Corrosion-Industries,* no. 376, Dec. 1956, p. 500-512. (CMA)

Survey of the metallurgy of titanium, the more important physical and chemical properties of titanium and its commercial alloys, and of their important applications in the U. S. These include their use by the Army and Navy and in the aeronautical and chemical industries.
(A general; Ti)

104-A. (French.) **Raoul de Vitry.** *Revue de Métallurgie,* v. 53, Dec. 1956, p. 915-929. (CMA)

A lengthy review on titanium metlurgy covers the important titanium ores, the production and refining of the metal, the various crystal modifications of titanium, melting and casting procedures, the physical metallurgy and important properties (physical and chemical) of titanium and its commercial alloys, and major applications. 12 ref. (A general; Ti)

105-A. (French.) **Uses of Cobalt.** M. Urbain. *Revue Universelle des Mines, de la Mécanique, de la Métallurgie,* v. 99, Dec. 1956, p. 621-630.

Metallic cobalt used principally for production of refractory metals employed in construction of gas turbines, aircraft reaction motors; magnetic alloys for permanent magnets; cutting and drilling tools, abrasion-resistant materials. Powder metallurgy techniques frequently used in some of above applications. Cobalt oxides and salts often used in ceramics and enameling industry; in colored pigments and drying agents for paints and varnishes. 25 ref.
(A general; SGA-h, Co, 17-7)

106-A. (French.) **Refractory Compositions of the Rare Earth Metals: Borides, Carbides, Nitrides and Sulfides.** F. Gaume-Mahn. *Société Chimique de France, Bulletin,* Nov.-Dec. 1956, p. 1862-1867. (CMA)

The refractory compounds formed by the rare earth metals and boron, carbon, nitrogen and sulphur, respectively, are reviewed. These compounds, particularly the borides and sulphides, are extremely stable and should find many interesting applications in the future. The melting points of the borides are about 2200° C., those of the sulphides about 2000° C. 28 ref.
(A general, P12n; EG-g, *B, C, N, S,* 14-18)

107-A. (German.) **Chemistry and Metallurgy of Zirconium.** H. O. Nicolaus. *Chemische Rundschau,* v. 10, Jan. 3, 1957, p. 1-4. (CMA)

Outline of principal facts related to the technology of zirconium and hafnium. An introductory statistical section is followed by the description of ores and their treatment, the main phases of the metallurgical process, the separation of hafnium, and the refining of the metal. 24 ref. (A general; Zr, Hf)

108-A. (German.) **Fire Prevention During Welding.** *Zeitschrift für Schweisstechnik,* v. 47, Jan. 1957, p. 12-14.

A pamphlet has been worked out containing safety precautions. The worker has to sign a slip to verify that he has read the pamphlet and will obey the given instructions.
(A7p, K general)

109-A. (Italian.) **Nickel and High Nickel Alloys for Pressure Vessels.** *Il Nickel,* Dec. 1956, p. 11-23.

Cold and hot forming, heat treatment and cleaning of materials under consideration. To be continued. (A general, T26q; Ni)

110-A. (Portuguese.) **Fiftieth Anniversary of Monel Metal.** Horace A. Hunnicutt. *ABM-Noticiario,* v. 10, Dec. 1956, p. 2-4.

History of Monel, starting with discovery in Canada of nickel-copper alloy in natural state; special characteristics, applications, variations. (A general, A2; Ni)

111-A. (Portuguese.) **Companhia Siderurgica Paulista—(COSIPA) (Paulist Steel Co.).** Arthur Noronha. *Engenharia, Mineracao e Metalurgia,* v. 24, Oct. 1956, p. 229-234.

Proposed new steelmaking facility to have joint government and private capital. Projected annual production of 300,000 tons of steel, to be achieved in four years. Reasons for locating works in Piassaguera; transport considerations; raw material sources. (A4; ST)

112-A. (Portuguese.) **Mineral Resources of the Mining Triangle.** Othon Henry Leonardos. *Engenharia, Mineracao e Metalurgia,* v. 24, Sept. 1956, p. 133-142; Oct. 1956, p. 219-226.

Parts II and III. Locations of deposits; analyses and comments on commercial possibilities of some. To be continued. (A11a)

113-A. (Portuguese.) **Iron and Steel Manufacture in Argentina.** Orlando Rangel. *Engenharia, Mineracao e Metalurgia,* v. 24, Sept. 1956, p. 145-154.

Facilities in plants existing and under construction; raw material requirements and supply; analyses of domestic iron ores; government program for manufacture of steel; consumption of iron and steel in Argentina from 1935 to 1948. 28 ref. (A4; Fe, ST)

114-A. (Portuguese.) **Brazilian Thorium Reserves.** Avelino Ignacio de Oliveira. *Engenharia, Mineracao e Metalurgia,* v. 24, Sept. 1956, p. 163-164.

Listing of known deposits. Studies being made to determine commercial possibilities. (A11a; Th)

115-A. (Portuguese.) **Brazilian Uranium Deposits.** Avelino Ignacio de Oliveira. *Engenharia, Mineracao e Metalurgia,* v. 24, Oct. 1956, p. 209-211.

Locations of known deposits. No known deposits with proven commercial possibilities, but bases exist for hope that such will be found. (A11a; U)

116-A. (Pamphlet.) **High Conductivity Copper Alloys.** 54 p. 1956. Copper Development Association, Pub. No. 51, 55 S. Audley St., London W. 1, England.

Fabrication, properties and applications of chromium, silver and tellurium copper. 51 ref. (A general; SGA-q, Cu, *Cr, Ag, Te*)

117-A. (Book.) **Minerals Yearbook, Metals and Minerals, Volume I.** 1953, U. S. Bureau of Mines, Washington 25, D. C. $4.50.

Covers mineral commodities, both metals and nonmetals, but exclusive of mineral fuels. Chapters on mineral technology, metallurgical technology and trends in technology and operations. (A4n; 14-9)

118-A. (Book.) **Manufacturing Methods and Processes.** Arthur C. Ansley. 561 p. 1957. Chilton Co., Chestnut and 56th Sts., Philadelphia 39, Pa. $12.50.

Developments in casting, stamping, forming, forging, extrusion, powder metallurgy, heat treating, finishing, inspection and automation. Designed for use of executives, engineers and production men. (A general, 1)

119-A. (Book.) **The Wire Industry Encyclopaedic Handbook.** 484 p. 1957. Wire Industry Ltd., 33 Furnival Street, London E.C.4, England.

Includes a review of the British wire industry for 1956, a directory of manufacturers and a comprehensive dictionary of wire and metallurgical terms. (A general; 4-11; 11-17)

120-A. (Book.) **Wrought Titanium.** 2nd Ed. 68 p. 1956. Imperial Chemical Industires, Ltd., London. (CMA)

The history and development of titanium is reviewed and the ICI nomenclature for alloys is given. Data are given for the physical and mechanical properties. The alloys Ti 318A (6% Al, 4% V), Ti 371 (13% Sn, 2.75% Al) and Ti 317 (5% Al, 2.5 Sn) are considered. Corrosion resistance data are tabulated, covering such agents as concentrated mineral acids, organic acids and aldehydes, halogens, metallic chlorides, salts and sea water. Recommendations are given for grinding, sawing, drilling, milling, planing, threading, hot working, descaling, electrodeposition, anodizing, forming, welding, brazing and soldering. Extensive weight-size tables for sheet, plate, wire, tubing and bar of variously shaped cross section are appended. (A general; Ti)

B Ore and Raw Material Preparation

12-B. (German.) **Methods of Modern Ore Dressing.** L. Frank. *Metall,* v. 11, Jan. 1957, p. 10-17.

Methods used in Germany with particular application to lead-zinc ores. Sorting, grinding, floating and sedimentation, chemical and combined processes described and illustrated. 10 ref. (B13, B14; Pb, Zn, 14-9)

13-B. **Selecting Crushing—the Preparation of Iron Ores by Impact Crushers.** E. Andreas. *Canadian Mining Journal,* v. 78, Jan. 1957, p. 56-59.

Description of the Hazemag impact crusher and reports on its use with siderite and limonite from German mines. (B13a; Fe, 14-9)

14-B. **Marquette Starts Jasper Plant.** *Engineering and Mining Journal,* v. 158, Jan. 1957, p. 76-79.

"Flying Saucer" and an updraft traveling grate for pelletizing are the innovations in new plant in Marquette Range. (B16b; Fe)

15-B. **Extraction of Uranium From Gold Ore Residues.** Peter Holz. *Indian and Eastern Engineer,* v. 119, Oct. 1956, p. 241-243.

Uranium production plants have been started in South Africa on a large scale. (B general, C general; U, Au)

16-B. **Fluidized Solids Technique: Magnetic Conversion of Iron Ores.** Robert J. Priestley. *Industrial and Engineering Chemistry,* v. 49, Jan. 1957, p. 62-64.

Design of profitable commercial plants; situations where this process is recommended. (B13g; Fe)

17-B. **Laboratory Studies on the Beneficiation of Some Ferruginous Manganese Ores of India for Production of Ferromanganese.** *Institution of Mining and Metallurgy, Bulletin,* no. 601, Dec. 1956, p. 49-68.

Equilibrium diagrams and reaction kinetics for production of ferromanganese. 23 ref. (B14; Mn, AD-n 31)

18-B. **Centrifugal Concentrating Pans.** *Mine and Quarry Engineering,* v. 23, Jan. 1957, p. 24-27.

Principle of operation, performance and applications of this type of mineral dressing equipment. (B14m, 1-2)

19-B. (Portuguese.) **Notes on Iron and Manganese Mines in Goa.** Abilino Vicente. *Técnica,* v. 31, Nov. 1956, p. 127-139.

Description of deposits; analysis of ores; history of mining operations since 1636. 6 ref. (B12, A11a; Fe, Mn)

C Extraction and Refining

32-C. **Arc and Vacuum Melting of Titanium.** D. E. Cooper and S. A. Herres. *Modern Metals,* v. 12, Jan. 1957, p. 74, 76, 78, 80, 82. (CMA)

Work of the Climax Molybdenum Research Laboratories is cited which proved useful in adapting to the vacuum arc melting of titanium. A furnace for titanium melting was developed. It was found that straight polarity direct current generated the most heat in the titanium pool; the current maximum is limited by the melting point of the electrode. For vacuum melting, the power supply is a 3-phase, full wave rectified direct current. Induction stirring, feedback control and magnetic arc control are other features discussed. (C5h, 1-23; Ti)

33-C. **Zirconium-Precipitation Pilot Plant.** G. T. Parish, et al. U. S. Atomic Energy Commission. AECD-3742, Sept. 30, 1950, 22 p. (CMA)

The pilot plant, which uses the phthalic acid precipitation of zirconium from $ZrCl_4$, was studied so that variables could be better controlled by design, and to determine the effect of leaching time on phthalate recovery. Data are tabulated and equipment modifications discussed. (C1p, A9j; Zr)

34-C. **Recovery of Iodine From Crystal Bar Unit Wash Water.** H. R. Hoge and Z. M. Shapiro. *U. S. Atomic Energy Commission. WAPD-RM-35,* June 20, 1951, 6 p. (CMA)

All iodine is thrown away, in the usual iodide zirconium process which involves recycling of the iodine three times. A survey is presented for iodine reclamation methods. The simplest and cheapest proved to be the chlorine oxidation of the iodines to free iodine, which is not too soluble in wash water. A plant design for such reclamation is suggested and a diagram is shown. 12 ref. (C1p, A11d; Zr, I)

35-C. (German.) **Electrolysis of Titanium From Melted Electrolytes.** Kurt Schwabe. *Freiberger Forschungshefte,* no. B17, 1956, p. 5-17. (CMA)

An outline of attempts by various workers at an electrolytic reduction of titanium is supplemented by a short description of the author's own experiments. With a melted mixture of K_2TiF_6 and NaCl as electrolyte he uses an anode made

of a compressed mixture of titanium dioxide and carbon. Lower chlorides of titanium probably form as an intermediate reaction product. This method introduces a titanium-containing anode for a continuous supply of titanium to the electrolyte. Only thin films of metallic titanium have been obtained so far. In another series of experiments the author supplies a graphite (or steel) anode with $TiCl_4$ vapors, using as a bath a eutectic mixture of alkali chlorides with a view to reducing the temperature of the process and thus obtaining a purer product. The method differs from procedures described in some British patents in that the deposition of titanium takes place directly, and not after a stepwise reduction of $TiCl_4$ into lower chlorides by means of multiple cathodes. 16 ref. (C23n; Ti)

36-C. (German.) **Arc Smelting in a Vacuum.** W. J. Kroll. *Metall,* v. 11, Jan. 1957, p. 1-7.

Electrical phenomena in diluted gases, glow discharge, sponge electrode and its properties, the hydrogen problem, smelting in a partial vacuum. 16 ref. (C25, C21d)

37-C. (Russian.) **"Anomalous" Valencies of Rare Elements in Processes for Their Separation. Communication I, The Electrolytic Reduction of Ytterbium.** D. I. Ryabehikov, Yu. S. Sklyarenko, N. S. Stroganova. *Zhurnal Neorganicheskoy Khimii,* v. 1, Sept. 1956, p. 1954-1967.

Conditions which influence separation of ytterbium by H. McCoy's method consisting of the electrolytic reduction of ytterbium sulphate in the presence of complex-forming citrate. (C23n; Yb)

38-C Molybdenum I. Production and Fabrication. D. O. Pickman. *Alloy Metals Review,* v. 8, Dec. 1956, p. 2-8. (CMA)

Properties and general uses of molybdenum reviewed. Molybdenum has, until recently, been produced exclusively by powder metallurgy, but vacuum arc melting is threatening to replace it. The improvements to be sought in molybdenum powder are lower oxygen content, better flow and larger particle size. Reduction in deep instead of shallow powder beds has advantages. Applicability of powder metallurgy method to making billets of several cwt. has been shown, but the arc-melting method is to be preferred; purity is improved by multiple melting. Homogeneous alloying is difficult by the arc melting method. Optimum properties in molybdenum are achieved by working the metal. Forging, joining and extrusion are discussed. 11 ref. (C general, H general, F general; Mo)

39-C. The Snow Lake Cyanidation Circuit. B. G. MacDermid and N. R. Stewart. *The Canadian Mining and Metallurgical Bulletin,* v. 50, Jan. 1957, p. 21-27.

Problems encountered in gold cyanidation circuit from 1949 to 1954, including need for close alkalinity control, temperature control, pre-aeration, and effects of lead salts and sodium cyanide vs. calcium cyanide. (C19p; Au)

40-C. Separation by Stages—New Bid For Pure Zirconium. *Chemical Week,* v. 80, Feb. 2, 1957, p. 58-59. (CMA)

A four-stage process of zirconium production is described which is based on selective reduction of $ZrCl_4$ to $ZrCl_3$ and disproportionation. USI has taken an option on the process, originated in Australia, for its Ashtabula plant. Zircon is converted to ZrC for a raw material. The use of chlorine vs. iodine in the process is discussed. (C1p; Zr-a)

41-C. Reduction of Titanium Chloride by Solutions of Alkalinous Metals in Their Fused Chlorides. R. S. Dean, et al. *Chicago Development Association, Contributions to Titanium Metallurgy. Paper No.* 1, 1957, 9 p. (CMA)

The coarse titanium crystals produced by reacting fused alkaline chloride solutions of both $TiCl_4$ and an alkaline metal are formed in an electrolytic cell in which the titanium chloride is produced anodically and the alkali metal is produced cathodically. Electrolyte compositions, electrode potential and crystal characteristics are discussed. 20 ref. (C23p, C1p, N12d; Ti)

42-C. The Chemistry of the Reduction of Titanium Chloride in Fused Alkalinous Chloride by Solutions of Alkalinous Metals. R. S. Dean, L. D. Resnick and I. Hornstein. *Chicago Development Association, Contributions to Titanium Metallurgy. Paper No. 3,* 1957, 9 pp. (CMA)

The equilibria in solutions of fused salts with titanium chloride and alkali metal and the conditions under which titanium forms were investigated; chemical analysis of the solutions was the tool used. The Ti^{+3} ion was determined in acidic ferric solutions and the amounts of free sodium, calcium and strontium present in their fused chlorides were checked by the cupric acetate-anhydrous methanol procedure. (None of the lower chlorides of titanium reduce copper below the cuprous state). The reactions are considered from the phase rule point of view. (C1k; Ti)

43-C. Electrodeposition of Metals From Organic Solutions. III. Preparation and Electrolysis of Titanium and Zirconium Compounds in Nonaqueous Media. W. E. Reid, Jr., J. M. Bish and A. Brenner. *Electrochemical Society, Journal,* v. 104, Jan. 1957, p. 21-29. (CMA)

Nonaqueous solutions of titanium and zirconium compounds were electrolyzed in electrodeposition attempts. Most promising were ether solutions of titanium and zirconium halides, hydrides, borohydrides and organometallics. A bath with hydrides and borohydrides gave Al-6Ti alloys and Al-45Zr alloys. Lower valent titanium compounds in organic solutions were studied. Preparative procedures are appended. 38 ref. (C23p; Ti, Zr)

44-C. Preparation of Zirconium and Hafnium Metals by Bomb Reduction of Their Fluorides. O. N. Carlson, F. A. Schmidt and H. A. Wilhelm. *Electrochemical Society, Journal,* v. 104, Jan. 1957, p. 51-56. (CMA)

A bomb reduction of zirconium and hafnium tetrafluorides with calcium is described. Reduction step studied and those factors which affect metal quality and yield determined. The zirconium produced was 99.8% pure and was readily cold rolled. Hafnium, however, was embrittled by atmospheric contamination and carbon; reduction yields of 96% were obtained. 7 ref. (C1p; Zr, Hf)

45-C. Anaconda's New Aluminum Plant Now Producing at Capacity. James F. Smith. *Engineering and Mining Journal,* v. 158, Jan. 1957, p. 80-85.

Plant patterned after Pechiney plant at St. Jean de Maurienne, France. (C general, A4p; Al)

46-C. Moab Mill Starts Making U_3O_8 Cake. Theodore Izzo, Lew Painter and Roman Chelminski. *Engineering and Mining Journal,* v. 158, Jan. 1957, p. 90-91.

America's latest uranium ore concentrating plant, the twelfth, uses resin-in-pulp process. (C19a; U)

47-C. Uranium From Gold Wastes. William Q. Hull and Ewen T. Pinkney. *Industrial and Engineering Chemistry,* v. 49, Jan. 1957, p. 1-10.

Uranium from pulp, ion exchange recovery, recovery of manganese, concentration by flotation, sulphuric acid production. 9 ref. (C19s, B14h; U, Au)

48-C. Electrodeposition of the Actinide Elements. Roy Ko. *Nucleonics,* v. 15, Jan. 1957, p. 72-77.

Experiments in the electrode position of actinide elements—thorium, uranium, neptunium, plutonium, americium and curium. 29 ref. (C23n; Th, U, Np, Pu, Am, Cm)

49-C. The Production of Zirconium and Hafnium. S. M. Shelton, E. D. Dilling and J. H. McClain. *Progress in Nuclear Energy Series V. Metallurgy and Fuels,* v. 1, 1956, p. 305-351. (CMA)

Zirconium ores, history, commercial production, uses and separation from hafnium are reviewed and discussed. Procedures for the production of reactor grade zirconium, including chlorination, purification, reduction, vacuum distillation, sponge handling, arc melting. Pure hafnium is produced similarly. 65 ref. (C general; Zr, Hf)

50-C. The Preparation and Properties of Rare Earth Metals. F. H. Spedding and A. H. Daane. *Progress in Nuclear Energy, Series V. Metallurgy and Fuels,* v. 1, 1956, p. 413-431. (CMA)

The best preparation of the high-purity lanthanons involves reduction of the trichloride with calcium under inert atmosphere in tantalum crucibles. However, samarium, europium and ytterbium are only reduced to the dichloride and are preferably prepared by reduction of the oxides with excess lanthanum or cerium and distilled. Methods of preparing the anhydrous fluorides are noted. Data are presented on melting points, vapor pressures, crystal structures, densities, resistivities, heat capacities, magnetic properties, thermal expansion and compressibilities. 32 ref. (C1p, P general; EG-g)

51-C. A New Acid Process for Uranium Ores. E. C. Bitzer. *Queensland Government Mining Journal,* v. 57, July 20, 1956, p. 497-499.

Uranium recovery process, grinding and leaching, ion exchange treatment. (C19s, C19n, B13c; U)

52-C. Electrodeposition of Titanium. W. E. Reid, Jr., J. H. Connor and A. Brenner. *U. S. Air Force, Wright Development Center, Technical Report 54-485, Part 3,* Sept. 1956, 18 p. (PB 121721). Abstracted in *U. S. Government Research Reports,* v. 27, Jan. 18, 1957, p. 18. (CMA)

Use of sodium or potassium borohydride as an alternative to lithium boronhydride studied in the preparation of titanium and zirconium borohydrides; chloroborohydride etherates of titanium were prepared for use in the Ti-Al bath. Magnesium alloys of titanium and zirconium were obtained from a hydride-type bath. Codeposition of hafnium and

thorium with aluminum from a borohydride bath was studied. (C23n; Ti, Zr, *Hf, Mg, Th, Al*)

53-C. Zirconium Purification Pilot Plant. D. C. Lea, et al. *U. S. Atomic Energy Commission, AECD-3743,* Sept. 12, 1950, 35 p. (CMA)

The operation of a pilot plant for zirconium purification was studied. The use of ammonium phthalate to precipitate zirconium selectively from $ZrCl_4$ is practical at this level of operation; loss of phthalate can be reduced to less than 20% and zirconium losses are slight. The procedure is improved by incorporating an overflow system, masking some of the filter section, use of a vacuum control valve, a more powerful agitator, flow meters for the zirconium feed, drains in the recycle drum, reduction of the amount of excess phthalate, and increasing the preheater temperature. (C27; Zr)

54-C. The Production of Zirconium by Fused Salt Electrolysis. M. A. Steinberg. *U. S. Atomic Energy Commission, NYO-1025,* Oct. 26, 1949, 116 p. (CMA)

Program for investigating the fused salt electrolysis of zirconium. Decomposition potentials of K_2ZrF_6 and $ZrCl_4$ in salt mixtures established. A survey of bath compositions show that NaCl with 25 to 35% K_2ZrF_6 is superior; 20-50 amp per sq. dm. current densities and temperatures above 1450° F. give good results, but use of higher densities and temperatures may give better results. Water washing of the bath was simplified. Retaining zirconium as a plate would make the method more attractive, and this may be accomplished at the higher temperatures. (C1p; Zr)

55-C. The Large Scale Separation of Zirconium and Hafnium. J. M. Googin. *U. S. Atomic Energy Commission Y-B65-103,* Sept. 4, 1956, 20 p. (CMA)

Only two Zr-Hf separation methods are economical for expanded operations: countercurrent extraction of the nitrates with tributyl phosphate, and countercurrent extraction of the thiocyanates from hydrochloric solution with methyl isobutyl ketone. The chemistry of the two processes is discussed at length, and equipment considerations are dealt with. The efficiency of the two is compared. 21 ref. (C28; Zr, Hf)

56-C. The Operation and Progress of the Properzi Mill. *Wire Industry,* v. 24, Jan. 1957, p. 65-66, 77.

Outlines Properzi's process for continuous casting of aluminum wire rod with special reference to the improved No. 6 model machine allowing a stated capacity of 3300 lb. of rod per hr. (C5q; Al, 4-5)

57-C. (French.) **The Manufacture of Aluminum.** Gaston Dufour. *L'Ingénieur,* v. 42, no. 168, Winter 1956, p. 7-11.

Description of the sources of supply of aluminum; methods of exploiting and treatment of bauxite; electrolytic reduction, smelting and casting. (C general, A11a; Al)

58-C. (German.) **Recent Developments in the Field of Molybdenum.** Friedrich Benesovsky. *Vakuum-Technik,* v. 5, Dec. 1956, p. 196-198. (CMA)

Three of the newer methods for the production of ingots from pure molybdenum powder outlined and advantages discussed. The starting material for all three methods is obtained by transformation of the molybdenum ore into MoO_3, its purification by sublimation at 700° C., followed by reduction with hydrogen in an electric furnace. Ingots are then produced either by direct sintering, indirect sintering or high vacuum arc-melting. (C21d, C5h, H15n; Mo)

59-C. (Russian.) **Cathode Process in the Deposition of Thorium From Fused Electrolytes.** M. V. Smirnov and L. D. Yushina. *Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk,* Nov. 1956, p. 1285-1293.

The polarization of a molybdenum cathode at 600, 700, and 800° C. during the electrolysis of thorium tetrachloride of tetrafluoride dissolved in a eutectic mixture of the chlorides of lithium and potassium was studied. It was established that at relatively low current densities reduction of Th^{4+} to Th^{2+} takes place at the cathode. (C23p; Th)

60-C. (Russian.) **Germanium and Its Applications.** N. P. Sazhin. *Khimicheskaya Nauka i Promyshlennost',* v. 1, Sept.-Oct. 1956, p. 487-491.

Chemical procedures by which pure germanium is prepared and the zone method of fractional crystallization, whereby a still higher degree of purity is achieved. Discusses germanium crystal detectors, the design of germanium point contact and junction diodes, germanium transistors (triodes), germanium rectifiers, photocells (photodiodes), thermistors, and film resistances. Reviews briefly the subject of germanium alloys. (C28k, T1; Ge)

61-C. (Russian.) **Elemental Silicon of High Purity.** N. N. Murach. *Khimicheskaya Nauka i Promyshlennost',* v. 1, Sept.-Oct. 1956, p. 492-495.

Applications of silicon, with particular stress on the uses of pure silicon as a semiconductor material. Critical review of methods for the production of pure silicon. (C general, T1; Si)

62-C. (Russian.) **Rubidium and Cesium, Their Applications and the Methods of Producing Them.** V. Ye. Plyushchev, Cand Chem Sci and I. V. Shakhno. *Khimicheskaya Nauka i Promyshlennost',* v. 1, Sept.-Oct. 1956, p.534-539.

Methods for the production of compounds of rubidium and cesium and of the metals themselves. Applications of the metals and of their compounds, with particular attention to uses in photocells. (C general, T1; Rb, Ce)

63-C. (Russian.) **Production and Applications of Selenium and Tellurium.** A. A. Solovushkov, L. A. Soshnikova and M. Y. Yezernitakaya. *Khimicheskaya Nauka i Promyshlennost',* v. 1, Sept.-Oct. 1956, p. 543-547.

Methods of production and applications of selenium and tellurium reviewed with reference to uses of selenium as a semiconductor material in photocells, rectifiers, etc., and to newly developed applications of tellurium as a semiconductor material. (C general, T1; Se, Te)

64-C. (Russian.) **The Use of Crystallization Processes for the Preparation of Highly Purified Substances.** D. A. Petrov and B. A. Kolachev. *Zhurnal Fizicheskoy Khimii,* v. 30, Oct. 1956, p. 2340-2347.

Purification of substances by the method of fractional "zone" crystallization from melts and the drawing out or "pulling" of monocrystals from molten material. Zone crystallization of silicon, iron, copper, platinum, silver, selenium, tellurium aluminum, indium, antimony, bismuth, and other elements. (C28k)

65-C. (Pamphlet.) **Electrolytic Titanium.** R. S. Dea, ed. Chicago Development Corp., Riverdale, Md., 1957, 35 p. (CMA)

In the titanium electrorefining process of Chicago Development Corp., $TiCl_{2,3}$ porduced at the anode and alkali metal solution at the cathode react to form titanium particles. The oxygen dissolved in the alloy is converted to TiO_2 and remains as an anodic residue. An analytical evaluation of electrolytes showed that NaCl-2.5% $TiCl_{2,3}$ is superior. The reaction equilibria, alloy behavior above the β transus, anodic behavior vs. cathode deposit structure, and preparation of the electrolyte and anode were studied. 13 ref. (C23p; Ti)

D Iron and Steelmaking

50-D. Developments in Open Hearth Operations. L. S. Moore. *Blast Furnace and Steel Plant,* v. 45, Jan. 1957, p. 48-49.

Trends and developments in furnace construction, refractories, raw materials, combustion and controls. (D2, W18)

51-D. Current Electric Furnace Practices at Atlantic Steel Company. Z. E. Willbanks. *Blast Furnace and Steel Plant,* v. 45, Jan. 1957, p. 50-52.

Charging, melting and refining practices and refractories used at Atlantic Steel Co. (D5)

52-D. More Iron Without More Furnaces. Charles M. Squarcy and Richard J. Wilson. *Blast Furnace and Steel Plant,* v. 45, Jan. 1957, p. 53-62.

Methods for improving blast furnace production are: use of sized ore, sinter, quality coke and high top pressure. Discusses use of oxygen and steam blast enrichment. 11 ref. (D1h)

53-D. Exothermics Raise Ingot Yields. G. N. Cherry. *British Steelmaker,* v. 23, Jan. 1957, p. 12-15.

Improvements in hot top linings and mold design in order to minimize cropping losses. (D9k, W19; ST)

54-D. Sulphurization From Fuel Oil. B. Trentini, A. Peters and G. Husson. *Iron and Steel,* v. 30, Jan. 1957, p. 11-17.

Investigation in basic openhearth fired by oils with varied sulphur content indicated a practically linear relationship between oil sulphur content and sulphur content in final steel. Sulphurization due to oil ceased when bath was completely covered with slag. Equality of sulphur partition coefficients indicated a near equilibrium in the distribution of sulphur between metal and slag phases. 17 ref. (D11n; ST, RM-k)

55-D. The Direct Measurement of the Total Heat in Open-Hearth Furnaces. A. M. Godridge and G. G. Thurlow. *Journal of the Iron and Steel Institute,* v. 185, Jan. 1957, p. 46-53.

Principle of the total heat meter and possible future uses. 6 ref. (D2h, X9)

56-D. An Investigation of the System $2FeO.SiO_2$-$3Na_2O.P_2O_5$-$Na_2O.2SiO_2$. C. Bodsworth and W. R. Maddocks. *Journal of the Iron and Steel Institute,* v. 185, Jan. 1957, p. 75-82.

Two quasi-binary systems forming part of the ternary system were investigated and a diagram of the ternary system constructed. No evidence could be found in X-ray patterns of the existence of stable ternary compounds. 12 ref.
(D11n; RM-q)

57-D. Enriched Blast in Basic Steelmaking. Pierre Coheur and H. Kosmider. *Metal Progress,* v. 71, Jan. 1957, p. 67-72.

Europeans find that the use of oxygen-enriched blast with or without supplementary oxygen through the converter's mouth speeds the steelmaking progress, consumes more scrap, utilizes offgrade pig iron, and broadens the applications of the steel produced. (D3f, 1-15; ST)

58-D. Scrap, Ingots, Smoke and Silicon. *Steel,* v. 140, Jan. 14, 1957, p. 78-81.

Electric furnace steelmakers discuss scrap prices, inoculation with ferrochrome powder, hot tearing relationships, smoke control and desiliconization. (D5; RM-p, ST)

59-D. Oxygen in British Steelmaking. D. J. O. Brandt. *Steel Review,* no. 5, Jan. 1957, p. 43-48.

Oxygen has recently become available at a price and in quantities which make it a practical alternative as an oxidizing agent for refining steel. Principal applications are in prerefining and lancing.
(D1h, D2g, D10)

60-D. (German.) **The Treatment on a Large Scale of Steel Melts Under Reduced Pressure.** F. Harders, H. Knueppel and K. Brotzmann. *Stahl & Eisen,* v. 76, Dec. 27, 1956, p. 1721-1728.

Theoretical principles of treating steel melts under reduced pressure. Design of a pilot plant. Gas removal during the vacuum treatment. Quality of vacuum-treated steels. Description of equipment for operation within the openhearth and basic converter steel plant. Effects of a subsequent vacuum treatment on the operation of a steel plant. 15 ref. (D8m; ST)

61-D. Coming Revolution in Steel-Making. *Engineering and Mining Journal,* v. 158, Jan. 1957, p. 99.

Cyclosteel process eliminates sintering, coking plants, blast furnaces, pelletizing and fluxing. (D8; ST)

62-D. Basic Bessemer Steel Blown With Mixture of Oxygen and Carbon Dioxide. *Iron and Coal,* v. 173, Dec. 28, 1956, p. 1539-1541.

The installation, mode of operation and analysis. Steel was regularly produced with nitrogen of 0.004% and below. (D3f; ST-g, 1-15)

63-D. The Special Steelmaker and Power Generation. Charles Sykes. *Iron and Coal,* v. 173, Dec. 28, 1956, p. 1543-1548.

On the metallurgical aspects, present and future problems of power generation with special reference to the manufacture of special steels.
(D general, W11)

64-D. Pre-Refining of Blast-Furnace Metal; System in Use at Maximilanshütte, Germany. *Iron and Coal,* v. 173, Dec. 28, 1956, p. 1553-1554.

Increase of molten metal temperature, rapid silicon removal in oxygen pre-refining. (D1h; Fe)

65-D. Iron and Steel Production in Countries Poor in Raw Materials. *Iron and Coal Trade Review,* v. 173, Dec. 21, 1956, p. 1489-1492.

Low-shaft furnaces, rotary furnaces, electric reduction furnaces, pig iron for the steelmaking process, present and future development.
(D8n, D8p, D8q; CI-a)

66-D. The "Kaldo" Rotary Oxygen Steelmaking Process. Bo Kalling and Felko Johansson. *Iron and Coal Trade Review,* v. 173, Dec. 21, 1956, p. 1497-1499.

Application and advantages of Swedish rotary furnace. (D10; ST)

67-D. Oxygen in Steelmaking. *Mechanical World and Engineering Record,* v. 137, Jan. 1957, p. 28-30.

Using oxygen instead of air or iron ore for openhearths, furnaces, superior castings, eliminating silicon, refining processes and arc furnaces. (D general; ST, *O*)

68-D. (French.) **The Solubility of Thomas Slag in Citric Acid.** A. Decker, A Delsa and R. Servin. *Revue Universelle des Mines, de la Mécanique, de la Métallurgie,* v. 99, Dec. 1956, p. 652-660.

Factors governing solubility; influence of chemical elements customarily used in solutions; influence of ground fineness of slag on solubility. (D11m; RM-q, ST-g)

E Foundry

46-E. Zircon Inventory. B. O'M. Jones. *Castings,* v. 2, no. 9, Nov. 1956, p. 7-8. (CMA)

Zircon is described as a mineral and as a byproduct from rutile-recovery operations. Properties are noted which explain its application as a core and molding material. Zircon sand has given good results in shell molding where proper binding is used. Precautions are given for the mixing of zircon sand.
(E18; NM-f45, *Zr*)

47-E. Making Ship Propellers With CO_2 Molds and Cores. Robert H. Herrmann. *Foundry,* v. 85, Feb. 1957, p. 105-109.

Methods of producing sodium silicate-bonded molds and cores hardened with CO_2 for casting bronze alloy propellers. (E19, E21; Cu-s)

48-E. How to Pour a Mold. Morris Gittleman. *Foundry,* v. 85, Feb. 1957, p. 110-111.

Specific recommendations for avoidance of defects and waste due to poor pouring practices. (E23)

49-E. Molding Practice in the Brass Foundry. Harry St. Johns. *Foundry,* v. 85, Feb. 1957, p. 112-115.

Current practices with advantages and disadvantages for brass of centrifugal casting, organic binders, shell molding, investment casting and metal mold casting.
(E14, E15, E16, E12; Cu-n)

50-E. Continuous Air Blast Control Improves Cupola Operation. E. J. Parker. *Foundry,* v. 85, Feb. 1957, p. 116-119.

Experience using conventional and small experimental cupolas with continuous blast control shows increased melting rate, lower coke to iron ratio and more fluid slag. (E10a)

51-E. Closures for Coreboxes. W. Hagedorn. *Foundry,* v. 85, Feb. 1957, p. 123-125.

Describes a variety of types of closures and their advantages for wood and metal coreboxes. (E21g)

52-E. Epoxy Resin Compound Is Versatile Foundry Tool. Robert E. Williams. *Foundry,* v. 85, Feb. 1957, p. 232-234.

Epoxy resin compound containing powdered aluminum used for repairing defective castings, cementing gates to patterns and modifying patterns. (E26, E17, NM-d)

53-E. Role of Castings in a Special Supercharger. *Light Metals,* v. 20, Jan. 1957, p. 27-28.

Design and casting process for supercharger for vehicle engines. (E general, 17-1, T21b; EG-a39, 5)

54-E. Improved Foundry Composition. A. Wittmoser. *Metal Progress,* v. 71, Jan. 1957, p. 84-87.

Traces of tramp elements have been found to be responsible for many costly aberrations in foundry products. At the same time, small additions of unusual elements will control microstructure in pearlitic gray iron, reduce annealing time for malleable castings, and improve tensile properties of alloy cast steels.
(E25q, 2-10; CI)

55-E. Specification: Pressure-Tight Castings. David H. Thorburn. *Precision Metal Molding,* v. 15, Jan. 1957, p. 52, 53; disc. p. 108-110.

Aluminum dies cast by impact injection. (E13; Al)

56-E. Soluble Cores: How and Where Used. Charles W. Schwartz. *Precision Metal Molding,* v. 15, Jan. 1957, p. 54, 55, 120.

Methods to solve problem of patterns with nonretractable cores, including use of soluble wax cores.
(E15, NM-d32)

57-E. Casting Forum on Technical Progress. *Steel,* v. 140, Jan. 7, 1957, p. 256-265.

Developments in the foundry and new fields of product application are outlined by 16 of the industry's leaders. A few of the advances mentioned are: gray iron use with new foundry methods, more pearlitic malleable for autos, new sand molding techniques. (E general; CI)

58-E. Soluble Cores Aid Casters. *Steel,* v. 140, Jan. 14, 1956, p. 70.

For complicated patterns involving nonretractible cores in investment casting a mixture of water soluble wax and powdered mica is suggested. (E15, W19; NM-d32)

59-E. Melting Change Brings Savings. *Steel,* v. 140, Jan. 21, 1957, p. 88.

Dry hearth melting furnace in small aluminum foundry conserves space, improves casting quality and gives greater economy in melting operations. (E10c, W19; Al)

60-E. (German.) **Technological Developments in the Foundry Industry.** Th. Klingenstein. *Metall,* v. 11, Jan. 1957, p. 29-30.

Electric furnaces for smelting of raw materials, new molding machines and techniques, and new molding materials.
(E10r, E19; RM-f45)

61-E. Sulphur in Cupola Stack Gases. F. M. Shaw. *British Cast Iron Research Association, Journal of Research and Development,* v. 6, Dec. 1956, p. 444-454.

Results indicate that 40 to 70% of the coke sulphur is absorbed by the metal and slag, by far the greater proportion going into the metal. Therefore, 60 + 30% remains in stock gases. At least one third of this can be removed by a spray and baffle-type collector.
(E10a; RM-j43, *S*)

62-E. Precision Casting Using Self-Setting Controlled Refractory Mold. *Canadian Machinery and Manufacturing News,* Dec. 1956, p. 640-642.

Shaw process of precision casting using a refractory mold of the split type, having good qualities of permeability, dimensional stability, resistance to thermal shock and chemical inertness at high temperature.
(E15; RM-h)

63-E. Green-Sand Moulding of Large Steel Castings. Charles W. Briggs. *Foundry Trade Journal,* v. 102, Jan. 10, 1957, p. 35-43.

Type of castings produced, facing sand mixture, backing sand and molding. Difficulties and advantages of green-sand molding. (E19a; ST, 5)

64-E. "Compo" and Chamotte Moulding. R. Wright. *Foundry Trade Journal,* v. 102, Jan. 17, 1957, p. 69-73.

Main characteristics, composition, preparation and mode of application of molding materials suitable for the production of heavy steel castings. (E19; ST)

65-E. Largest Steel Casting? *Foundry Trade Journal,* v. 102, Jan. 17, 1957, p. 79-81.

The largest steel casting exhibited at Dusseldorf; casting technique. (E11; ST)

66-E. Precision Casting by the Lost Wax Process. R. G. Nicholas. *Institution of Production Engineers Journal,* v. 35, Dec. 1956, p. 727-740.

Patterns, dies, injection technique, moldmaking and quality of the precision castings. (E15)

67-E. Cast Titanium Gets Set for Commercial Use. *Iron Age,* v. 179, Feb. 7, 1957, p. 102-105. (CMA)

New developments have made commercial titanium castings feasible. Titanium castings without surface contamination are now available. Parts are cast oversized in a graphite mold, then pickled to size to remove contaminated surface. Electric arc and induction furnaces may be used for melting. Breech blocks weighing 75 lb. are cast by the Bureau of Mines. Skull-melting with copper crucibles is discussed. Battelle gets the best shell molded finish from electrically fused alumina-0.5% $MgSiF_6$. Baked sand molds promise less, while expendable molds of compressed graphite powder offer much. (E general; Ti)

68-E. Designing Gray Iron Castings. Arthur Scharf and Charles F. Walton. *Machine Design,* v. 29, Jan. 10, 1957, p. 104-122.

Casting methods and foundry facilities, design procedure. 20 ref. (E11, 17-1; CI-n)

69-E. Effects of Vibration During the Solidification of Castings. *Machinery,* v. 90, Jan. 11, 1957, p. 73-75.

Results of vibration at sonic and subsonic frequency; it was found that there is a substantial improvement in physical properties at frequencies of 4000 to 5000 vibrations per min. (E25n, 1-24)

70-E. The Effect of Cavity Proportions Upon Metal Flow. H. K. Barton and L. C. Barton. *Machinery,* v. 90, Jan. 25, 1957, p. 201-209.

Discussion of metal flow within dies and conditions of temperature and pressure prevailing. Notes also the effects of different injection pressures on the manner in which the cavity is filled, the factors limiting injection pressures, and the nature of the turbulence produced. (E13)

71-E. Frozen Mercury Casting Methods. *Mechanical World and Engineering Record,* v. 137, Jan. 1957, p. 20-21.

The use of frozen mercury as a pattern agent overcomes some of the limitations of investment casting with wax or plastic patterns. Notably, the final mold may be produced with a very thin shell for better metallurgical control. (E15)

72-E. Planning for Heat Treating in Malleable Iron Foundries. J. T. Bryce, L. E. Emery, F. W. Jacobs, L. R. Jenkins, G. B. Mannweiler and William Zeunik. *Modern Castings,* v. 31, Feb. 1957, p. 39-54.

Selecting proper foundry practices and economical equipment. (E11, J general; CI-s)

73-E. Soluble Wax Cores Solve the Impossible. C. W. Schwartz. *Modern Castings,* v. 31, Feb. 1957, p. 56-58.

Investment castings by wax mica material. (E15; NM-d32)

74-E. Charting the Way to Cupola Quality Control. Morris Gittleman. *Modern Castings,* v. 31, Feb. 1957, p. 58-60.

Types of reports necessary for quality control. (E10a, S12)

75-E. (French.) **Practical Processes of Degassing of Light Alloys.** Claud Mascré and André Lefebvre. *Fonderie,* no. 131, Dec. 1956, p. 496-508.

Discusses and compares three processes of degassing, natural bubbling of nitrogen, bubbling of hexachlorethane, and selecting the best and most practical method of degassing of baths of light alloys such as aluminum. 16 ref. (E25s; Al)

76-E. (French.) **Cast Iron Smelting Methods in Cupola Furnaces—Industrial Induction Furnaces.** *Metallurgie et la Construction Mecanique,* Dec. 1956, p. 1011-1015.

Iron casting with the cupola furnace and the induction furnace, noting the uses and the relative advantages and disadvantages of each for various types of casting. (E10a, E10r, 1-2; CI)

77-E. (Report.) **Properties of Molding Sands Under Conditions of Gradient Heating.** N. C. Howells, R. E. Morey and H. F. Bishop, Naval Research Laboratory, U. S. Office of Technical Services, P.B. 121540, Washington 25, D.C. $.50.

A new hot strength test to determine properties of molding and core sands. (E18, 1-4)

78-E. (Report.) **The Effect of Ultrasonics on Molten Metals.** J. B. Jones, J. G. Thomas and C. F. DePrisco. 127 p. Jan. 1955. Aeroprojects Inc. for Wright Air Development Center. U. S. Office of Technical Services, P.B. 121403, Washington 25, D.C. $3.25.

Reproducible degassing of a melted aluminum alloy by ultrasonic activation. Grain refinement of the alloy with elastic vibratory energy. (E25q, E25s, 1-24; Al)

F Primary Mechanical Working

37-F. Wide Flange Beam Rolling at Inland Steel Co. W. E. Dittrich. *Iron and Steel Engineer,* v. 34, Jan. 1957, p. 67-75

Structural mill to roll both wide flange and conventional sections. The mill rolls wide flange beams from 8 x 5¼ in. to 24 x 9 in. Rolling rates of 778 tons per turn on 10 x 5¾ in. section attained. (F23; ST, 4-7)

38-F. Steel Mill Drives—Past, Present and Future. R. H. Wright. *Iron and Steel Engineer,* v. 34, Jan. 1957, p. 76-81.

Progress of steel mill industry from 1907 and its probable future developments. Rolling mill drives are emphasized. (F23, W22, A2; ST)

39-F. Symposium on Titanium IV. Practical Problems Associated With the Control of Interstitials II. Control of Interstitials in Titanium Melting and Mill Processing. L. S. Busch. *Journal of Metals,* v. 9, Jan. 1957, p. 181. (CMA)

Heating titanium ingots in gas-fired furnaces, annealing or hot rolling, and chemical cleaning increase the hydrogen content with every operation; electric heating, though expensive, would be advantageous. Oxygen contamination is more serious, and the oxide scale must be removed by pickling. (F21b, F23, 3-19; *Ti, O*)

40-F. Glass Baths for Heating Steel Extrusion Billets. Osvaldo Balestra. *Metal Progress,* v. 71, Jan. 1957, p. 109-112.

Considerable savings in fuel and maintenance cost have been realized by using a gas-fired molten glass bath instead of a salt bath for preheating steel extrusion billets. (F21b, F24; NM-f42)

41-F. Advances in European Drop Forging. Tom Bishop. *Metal Progress.* v. 71, Jan. 1957, p. 113-115.

Industry-sponsored investigations of drop forging practice have resulted in increased die life and more efficient equipment. (F22n)

42-F. Heat Treating Practice in Russian Steel Mills. Lee Wilson. *Metal Progress,* v. 71, Jan. 1957, p. 116-121.

First-hand observations of Russian production equipment and techniques obtained during a visit to two steel mills during 1956. (F general, D general, J23)

43-F. Shearing Squares up Billet Ends. W. C. Tucker. *Steel,* v. 140, Jan. 14, 1957, p. 75-76.

Need for billets that are square at both ends met by the use of confining shear. (F29q; ST, 4-2)

44-F. Fabrication of Molybdenum Sheet. J. R. Van Orsdel and R. B. Fischer. *U. S. Atomic Energy Commission, BMI-*1151, Dec. 5, 1956, 10 p. (CMA)

Fabricating molybdenum into 1/16-in. sheet with good ductility at 25° C. was studied; an unfibered grain structure was desired. The important variables are found to be the initial and final rolling temperatures, ingot thickness at the beginning of the finish-rolling step, reduction rate, and time and temperature of heat treatment. Wrought molybdenum sheet can be prepared without fibering and with adequate ductility; a small amount of residual cold work is needed and indicates the optimum recrystallization. (F23; Mo, 4-3)

45-F. Fabrication of Zirconium "S" Rod Thimble Tubes. R. M. Treco, G. T. Murray and R. S. French. *U. S. Atomic Energy Commission. BRB-1,* Jan. 1955, 71 p. (CMA)

A detailed procedure is presented for fabricating zirconium and Zircaloy-2 "S" rod thimble tubes for AEC purposes. Specifications are given. The procedure includes extrusion, tube working, welding and assembly. Twelve tubes meeting rigid specifications were fabricated for du Pont. (F24, K general; Zr, 4-10)

46-F. (German.) **Manufacture of Flat Wire.** A. Ball. *Draht,* v. 7, Dec. 1956. p. 459-464.

A thorough discussion of flat wire as a secondary product of the wire industry including general specifications, raw materials, cold rolling and maintenance of equipment, continuous rolling, coiling and uncoiling, arrangement of rollers, and production planning. (F28)

47-F. (German.) **Automation in the Cold Rolling Mill.** *Stahl und Eisen,* v. 76, Dec. 13, 1956, p. 1665-1668.

Variations in raw products, most reasonably priced materials, operation by common skilled laborers, and use of available equipment. The human element should be omitted to obtain increased efficiency with regard to strip velocity, gage and straightness. 5 ref. (F23, 1-17, 18-24)

48-F. (German.) **Testing Rolling Oil Emulsions by the Wire Drawing Test.** Werner Lueg and Winfrid Dahl. *Stahl und Eisen,* v. 76, Dec. 13, 1956, p. 1669-1671.

Wire drawing was not found to be the proper means of rating lubricating power of rolling oil emulsions. Comparisons are made with cold rolling tests. 5 ref. (F28, 1-4; NM-h)

49-F. (German.) **Effect of Finishing Operations on the Elastic Properties of Steel Wire.** Wilhelm Puengel. *Stahl und Eisen,* v. 76, Dec. 13, 1956, p. 1685-1689.

Effect of the preliminary and finishing straightening operation on the properties, particularly on the elastic properties of steel wire. Behavior of heat treated wire. Effect of the size of the coil. Subsequent treatment by prestressing. 7 ref. (F29r, G23q, Q21; ST, 4-11)

50-F. (German.) **Automation of a 12-Roller Reversing Cold Rolling Mill.** Herbert Schmale. *Stahl und Eisen,* v. 76, Dec. 13, 1956, p. 1698-1700.

A description of the mill; automatic thickness control brings about greater accuracy of gage; deviations in thickness of the complete strip are held to a minimum; dependence upon the reliability of the operator is negated; cost decreases achieved through use of fewer personnel. (F23, 1-17, S14, 18-24; ST)

51-F. (Russian.) **Study of the Conditions of Titanium Alloy Rolling.** V. K. Belosevich, V. F. Kalngin, N. I. Korneev, I. M. Pavlov, I. G. Skucharev and A. E. Shelest. *Akademiya Nauk S.S.S.R. Izvestiya. Otdelenie Tekhnicheskikh Nauk,* no. 10, 1956, p. 15-27. (CMA)

Experiments with a Ti-Al alloy used for sheet rolling demonstrated the advantage of rolling at a temperature above 1000° C. This finding was based on the following observations. Whereas below 950° C. the alloy has the structure of the α-phase, above 1000° C. the structure is that of the β-phase whose plasticity is higher than that of α. It should be borne in mind, however, that the absorption of gases is very intensive in the β region and that consequently, the heating should not be prolonged beyond the time necessary for reaching the desired temperature throughout the thickness of the metal. 7 ref. (F23, 2-11; Ti, 4-3)

52-F. **Automation in the Drop Forging Industry.** H. M. Fox. *Institution of Production Engineers Journal,* v. 35, Dec. 1956, p. 747-750.

Heating arrangements, other kinds of heating and heat treatment. (F22n, F21b, 18-24)

53-F. **Stepped Extrusions.** C. J. Hoffman. *Materials and Methods,* v. 45, Jan. 1957, p. 101-103.

New development of an aluminum extrusion having two or more different cross sections. (F24; Al)

54-F. **Taper Heating of Aluminum Extrusion Billets.** A. J. Mueller. *Metal Progress,* v. 71, Feb. 1957, p. 76-77.

During extrusion, the temperature of aluminum billets increases by as much as 150° F. To obtain uniform properties of the extrusion, the billet should be preheated with a temperature differential by a special three-section induction coil. (F24, F21b; Al)

55-F. **Pieces by the Slice.** *Steel,* v. 140, Feb. 4, 1957, p. 101-104.

Potential applications of extruded steels, with properties and size and shape limits. (F24, Q general; ST, 17-7)

56-F. **The Present State of Scientific Knowledge in Hot Shaping or Forging.** Eric Siebel. *Steel Processing,* v. 43, Jan. 1957, p. 19-24.

Elementary methods of hot shaping and the formulation of basic rules for shaping in the plastic state. The formulas are explained according to the properties of the material, temperature, deformation rate and the degree of shaping. (F22, Q23q)

57-F. **A Commercial Extrusion of Zircaloy-1.** J. Halapatz. *U.S. Atomic Energy Commission WAPD-RM-189,* June 9, 1953, 14 p. (CMA)

Procedure for extruding Zircaloy-1 tubes from suitable sponge. Protective sheathing was unnecessary; the salt from the bath used to heat the billet served effectively as a lubricant. A re-evaluation of the Ugine-Sejournet process is urged. (F24; Zr)

58-F. **Zircaloy Thimble for KAPL-120 Loop.** G. C. Westfall. *U.S. Atomic Energy Commission KAPL-M-GOW-1,* Aug. 28, 1956, 19 p. (CMA)

Extrusion of heavy-walled Zircaloy tubing studied. An integral co-extruded hemispherical tip was specified. A Zircaloy thimble for a reactor is feasible, but design problems were encountered. The flux advantage over stainless steel is considerable. (F24, T11p; Zr)

59-F. **Development of a Fabrication Procedure for Zircaloy-2.** M. L. Picklesimer and G. M. Adamson. *U. S. Atomic Energy Commission CF-56-11-115,* Nov. 1956, 19 p. (CMA)

Heating Zircaloy-2 plate into the all-β field causes the disappearance of stringers which are evident after rolling the plate at 1550° F. Since stringers affect the properties of the notch-sensitive Zircaloy-2, a study of an alternative method of fabrication was conducted. The procedure developed consists of fabricating above 1780° F. or below 1490° F. and then heating to 1832° F. for 30 min., water quenching or air cooling, and then cold or "warm" rolling to 20% reduction. Annealing at 1472° F. for 15 to 30 min. follows. Another advantage is the decrease in preferred orientation. (F23, 1-16; Zr)

60-F. **Bending by Rolling of Ferrous and Non-Ferrous Plate—3.** E. L. Tinley. *Welding and Metal Fabrication,* v. 25, Feb. 1957, p. 66-67.

Practices in the elimination of flat ends; flexing roll machines; shipyard rolls. (F29r)

61-F. **From Wire Rod to Wire Rope.** *Wire Industry,* v. 24, Jan. 1957, p. 53-56.

Details of the drawing of wire and methods of construction of wire rope at the Martin Black and Co. (Wire Ropes) Ltd., Coatbridge, Lanarkshire, Scotland. (F28, K13s, T7g)

62-F. (French.) **The Manufacture of Monolithic Boiler Bodies in Forged Steel.** *Metallurgie et la Construction Mecanique,* Dec. 1956, p. 1017-1023.

Procedures employed in casting of ingots weighing as much as 270 tons and the production of boiler bodies forged in one piece. Methods of casting, cutting, core-drilling, tapping and cold working are discussed, together with the advantages gained from this technique. (F22, D9; ST)

G Secondary Mechanical Working

Forming and Machining

39-G. **Wood Shapers Rout Super-alloys at 2000 Sfpm.** H. J. Tangerman. *American Machinist,* v. 101, Jan. 14, 1957, p. 107-108.

Boeing Airplane Co. using CO_2 as a cutting fluid routs titanium, 400 series stainless and magnesium alloys. (G17c; Ti, Mg, SS)

40-G. **Shock Forming With Explosives.** E. J. Tangerman. *American Machinist,* v. 101, Jan. 14, 1957, p. 110-111.

Possibility of using explosives to cope with some of the problems in the field of fabrication of high tensile stainless steels and titanium alloys. (G general, NM-k34; SS, Ti)

41-G. **Explosives Fabricate Metal at Lockheed.** Glen N. Rardin. *American Machinist,* v. 101, Jan. 14, 1957, p. 112-115.

Preliminary investigations in hole punching, pressure forming with low explosives and pressure forming with high explosives point out the constructive future of explosives in industry. (G general; NM-k34)

42-G. **What Chips Really Mean to Carbide Cutters.** Horace Frommelt. *Iron Age,* v. 179, Jan. 10, 1957, p. 59-62.

Points to watch in milling practice as indicated by chip clearance, chip size and method of milling. (G17b)

43-G. **Press Draws Heavy Torque Tube Flanges.** *Iron Age,* v. 179, Jan. 10, 1957, p. 69.

Flange for automobile automatically drawn with successive dies from hot rolled steel. (G4, W24; CN)

44-G. **Effect of Stamping Plant Requirements on Steel Industry Operations.** A. J. Hole. *Iron and Steel Engineer,* v. 34, Jan. 1957, p. 89-91.

Stamping plant requirements are: wider sheets of improved drawing quality, finer surface finishes, greater ductility, better scheduling and packing. (G3, Q23q; ST, 4-3)

45-G. **Some Examples of Bonded Diamond Tools.** *Machinery,* v. 90, Jan. 4, 1957, p. 18-20.

Diamond surface wheel for grinding compacted tungsten carbide in the green state. (G18k, NM-k37; W, 6-19)

46-G. **Stretch-Forming Titanium Sections.** R. A. Kiehl. *Machinery (London),* v. 89, Dec. 28, 1956, p. 1451-1452. (CMA)

Stretch-wrapping is a suitable way to fabricate Ti-8Mn if proper precautions are taken. Workpieces should have machined or polished edges, be carefully inspected for flaws and have an acid etching prior to forming. A good grip by the machine is assured if hardened jaws with sharp, clean serrations are used. Overforming on the stretch-block compensates for springback. Close dimensional control, frequent inspections and stress-relief are also important. (G9; Ti)

47-G. **Russians Discover Spark Cutting.** *Metal Progress,* v. 71, Jan. 1957, p. 121-125.

Pressing and forming dies of chromium steel are formed with brass or copper-graphite tools, usually in three stages. Reconditioning of dies is also recommended. A very thin but very hard, wear resisting layer on cutting tools and machine parts is produced by sparking dry while vibrating the contacts continuously. (G24a, T6; TS)

48-G. Getting Titanium Parts Mass Produced. J. L. LaMarca and J. L. McCabe. *Society of Automotive Engineers, Journal,* v. 65, no. 1, Jan. 1957, p. 75-77. (CMA)

The four great manufacturing problems for titanium jet parts are getting acceptable forgings, heat treating to recover ductility, development of machining processes, and reducing the hydrogen content. Solutions to these problems have come forward with greater experience. Vacuum annealing effectively reduced the hydrogen content, changing tool geometry was helpful in machining and a heat treatment was developed in the form of a descending isothermal plateau. (G17, J23, 1-23; Ti)

49-G. Lubrication Forum on Technical Progress. *Steel,* v. 140, Jan. 7, 1957, p. 409-416.

Brief comments on recent trends by 15 authorities. A few of these are: new water solubles good for both cutting and grinding, silicones conquer both high and low temperature problems and lubrication becomes more centralized and automatic. (G17, G18, 18-23; NM-h)

50-G. Cold Heading Branches Out. *Steel,* v. 140, Jan. 14, 1957, p. 71-74.

The advantages including increased strength, material savings, difficult configurations, close tolerances and high production rate have stimulated the use of this process for production of large variety of small parts. (G10, 1-17)

51-G. Belt Grinding Adapted to Motor Rotor Finishing. *Tooling and Production,* v. 22, Jan. 1957, p. 151.

Specially fixtured abrasive belt grinder finishes motor rotors to 0.0001 in. concentricity tolerance. (G18k)

52-G. Bending by Rolling of Ferrous and Non-Ferrous Plate—2. E. L. Tinley, M. I. Mech. *Welding and Metal Fabrication,* v. 25, Jan. 1957, p. 24-27.

Functions of pyramid and pinch type machines with reference to minimum diameter of cylinders rolled, completed cylinder removal, overload protection, roll crowning, roll surfaces, roll drive, and interchangeability of top roll. (To be continued.) (G11, W23)

53-G. Cold Extrusion of Unalloyed Titanium. A. M. Sabroff, O. J. Huber and P. D. Frost. *American Society of Mechanical Engineers, Paper 56-A-88,* 1956, 8 p. (CMA)

The successful cold extrusion of titanium has been demonstrated by Battelle; the grades used had yield strengths of 45,000 and 70,000 psi. A smooth surface was obtained and seizing, and galling were prevented by use of a fluoride-phosphate coat and an oil-graphite-MoS_2 lubricant. Bars extruded to 40%, 50% and 60% reductions had adequate ductility and strength increases up to 60%. (G5; Ti)

54-G. Economic Factors Must Govern Wheel Selection for Grinding Carbides. F. J. Lennon. *Australasian Engineer,* v. 49, Nov. 7, 1956, p. 89-97.

Grinding of sintered carbide can be accomplished with silicon carbide abrasives. (G18; NM-j, 6-19)

55-G. Ultrasonic Machining of Hard Metals. N. Pudney. *Australasian Engineer,* v. 49, Nov. 7, 1956, p. 100-107.

Description of the process; generation of ultrasonic vibration, cutting rates, cutting mechanism and surface finish. (G24c)

56-G. More Work With Fewer Wheel Changes. John E. Hyler. *The Australasian Manufacturer,* v. 41, Dec. 1, 1956, p. 72-73.

Abrasive wheels as grinders. (G18)

57-G. Cemented Carbide Dies for Hot Heading Titanium Bolts. *Automotive Industries,* v. 116, Jan. 15, 1957, p. 100. (CMA)

Voi-Shan Mfg. Co. switched to cemented carbide dies in hot heading titanium aircraft bolts, and increased production 16 times. The increase is attributed to improved resistance to galling and seizing. Hot heading is used in preference to cold heading because of the superior physical qualities of the fastener. The process is described. Special precision-built Carboloy grade 190 dies last as long as 50,000 bolts before failure.
(G10, 1-16; Ti)

58-G. Formability of Metals, Part 4. Lester F. Spencer. *Finishing,* v. 14, Jan. 1957, p. 75-79.

Roll forming high nickel alloys; suitable alloys; forming contoured sections. 10 ref. (G11; Ni)

59-G. Chem-Mill: a Chemical Process Which Does the Work of Milling Machines. *Industrial and Engineering Chemistry,* v. 49, Jan. 1957, p. 129A-130A.

Etching reaction, solution control and instrumentation. (G24b)

60-G. Gouging Castings With Carbon Arc Speeds Preparation for Welding. Ted Roberts. *Industry and Welding,* v. 30, Feb. 1957, p. 82-86.

Carbon-arc compressed air torch used in gouging cast segments of turbine. (G22; ST, 5)

61-G. Research Into Some Metal-Forming and Shaping Operations. W. Johnson. *Sheet Metals Industries,* v. 14, Jan. 1957, p. 41-50.

Investigation on drawing and redrawing of cylindrical shells. Summarizes knowledge of the mechanics of certain metalworking operations as studied in theory at the University of Sheffield over a number of years. 9 ref. (G4)

62-G. The Metallurgy of Steels for Deep Drawing. A. J. K. Honeyman. *Sheet Metals Industries,* v. 14, Jan. 1957, p. 51-65.

Brief description of cup-drawing. Survey of factors influencing deep drawing such as composition of steels, grain size and structure, mechanical properties, directionality, stabilized steels, yielding, aging, etc. Methods of assessing deep drawing discussed. 14 ref. (G4c, Q23q; ST)

63-G. Research Into Some Metal-Forming and Shaping Operations. W. Johnson. *Sheet Metal Industries,* v. 34, Feb. 1957, p. 121-127.

Detection and measurement of residual stresses in cold drawn tubes, impact extrusion, and coining. (concluded.) 16 ref.
(G4, 1-17, G5, G3n, Q25h)

64-G. Phases of Hole Grinding, Part II. John E. Hyler. *Steel Processing,* v. 43, Jan. 1957, p. 31-35, 45.

Drives, speeds, wheel selection, wheel mounting and wheel dressing for precision internal grinding.
(G18j, 1-2)

65-G. Preparation and Testing of a Titanium-Lined Pipe Section for Standard Ring-Joint Gaskets. V. M. Hovis, et al. *U. S. Atomic Energy Commission,* K-1288, Jan. 23, 1957, 33 p. (CMA)

A pipe is described which was fitted with a liner made of welded titanium tube. A hot spinning method was successful in extending titanium out over flanges. Tests were conducted with pressures up to 2000 psi. at 600° F. and showed that the joint was leak-tight. Stainless steel gaskets, gold plated, were satisfactory and prevented damage to the titanium liner.
(G13, 1-16, Q10; Ti, 4-10)

66-G. Metal Gathering by the Resistance-Heating Process. W. F. Haessly. *Welding Journal,* v. 36, Feb. 1957, p. 132-140.

Metal gathering or "progressive resistance hot upsetting" by the 60-cycle resitance heating method is having greater use in the forming of such metals as Silicrome valve steels, jet engine turbine blades and other aircraft parts. The variables that must be controlled, techniques involved, application information and results. (G general, K3, 1-2; SGA-h)

67-G. Boeing Uncorks Bottleneck, Licks Forming Problems on Titanium Alloys. *Western Metals,* v. 15, Jan. 1957, p. 62-63. (CMA)

Ti-6A1-4V sheet can be formed on typical equipment at both room and high temperatures, and this fact is applied by Boeing in airframe construction. Forming must be complete enough to allow cold clamping of the part in the aging treatment (4 hr. at 1000° F); the fixture used is described. Most Ti-6A1-4V forming is done in the annealed state. A 6t bend radius is possible with conventional equipment at 68° F. A formability index is shown graphically which compares Ti-6A1-4V with RC-70 and other titanium alloys.
(G general, Q23q; Ti)

68-G. (Portuguese.) **Cold Extrusion of Steel.** Waldemar de Lima e Silva. *Engenharia, Mineracao e Metalurgia,* v. 24, Oct. 1956, p. 203-206.

Cold working of metals; definition of cold extrusion; backward and forward processes; steel suitable for successful extrusion, proper tooling, lubrication, presses. (G5; ST)

H Powder Metallurgy

8-H. Rate of Capillary Rise of Liquid Metal in a Higher Melting Metal Powder Compact. K. A. Semlak, C. W. Spencer and F. N. Rhines. *Journal of Metals,* v. 9, Jan. 1957, p. 63, 64.

Investigation of capillary rise of liquid copper, saturated with iron, in a column composed of partially sintered iron powder. 2 ref.
(H general, P13; Cu, Fe)

9-H. Properties of Aluminum Powders and of Extrusions Produced From Them. F. V. Lenel, A. B. Backensto, Jr. and M. V. Rose. *Journal of Metals,* v. 9, Jan. 1957, p. 124-130.

Tensile strength and yield strength of extrusions are functions of powder particle size or flake powder thickness. Oxide content, except as it depends on flake thickness has only a minor effect; degree of dispersion of the oxide appears to be the controlling factor in the strengthening mechanism of extrusions. 17 ref.
(H11, Q23c, Q27a; Al, 4-8)

10-H. A Guide to Using S.A.P. R. Irmann. *Precision Metal Molding,* v. 15, Jan. 1957, p. 58-63; disc., p. 120.

Sintered aluminum powder, properties, processing techniques and applications. (H general; Al)

11-H. Investigation of Possible Methods for Consolidating Zirconium Sponge for Use as Consumable Electrodes. H. R. Hoge. *U. S. Atomic Energy Commission. WAPD-RM-*152, Nov. 7, 1952, 8 p. (CMA)

Methods for consolidating zirconium sponge into forms suitable as electrodes were studied and included hot compacting, cold compacting, sintering of compacts by induction and by resistance heating, and extrusion. Each method has its advantages and disadvantages. Prior compacting seems desirable in all cases. Cold compacting to over 70% density produces acceptable electrodes. Induction sintered and extruded electrodes show much promise.
(H14, H15, W18; Zr)

12-H. (German.) **Short Description of Powder Techniques in Connection With Properties and Behavior of Iron Oxide Aerosols.** R. Meldau. *Archiv fur das Eisenhüttenwesen,* v. 27, Nov. 1956, p. 673-679.

Description of separation of iron oxide from "brown smoke". Dependance of separation upon temperature and amount of steam added. Use of iron oxide pigment in dyes, paints and sintered metals. 26 ref. (H10, T29; Fe)

13-H. Basic Research on Sintered Titanium Powder Analogous to "SAP" for High-Temperature Strength. Summary Report. E. P. Weber. *Clevite Corp. Summary Report under contract NOas 55-505-C,* June 1956, 44 p. (PB 121559) Abstracted in: *U. S. Government Research Reports,* v. 27, Feb. 15, 1957, p. 59. (CMA)

TiH_2 of 5-10 μ particle size can be made, compacted, dehydrogenated, sintered and extruded to rod possessing good strength, ductility and tensile properties. Silicon can be coated on the particles by vapor phase reduction of $SiCl_4$ with hydrogen. Sintering and dehydrogenating below 800° C. does not rupture the silicon film. ThO_2 is stable as a disperse phase up to 1200° C. and hardens effectively if the dispersion is fine enough.
(H general, Q27a, 2-12; Ti)

14-H. Manufacture of Reduced Iron Power for Micro-Wave Attenuators. Astuo Nishioka. *The Electrical Communication Laboratory, Nippon Telegraph and Telephone Public Corp, Reports,* v. 4, Aug. 1956, p. 16-19.

Chemical reduction method for the production of iron powder.
(H10c; Fe)

15-H. Particle Size Distributions of Iron Powders. Astuo Nishioka. *The Electrical Communication Laboratory. Nippon Telegraph and Telephone Public Corp. Reports,* v. 4, Aug. 1956, p. 33-36.

Measurement of particle size distribution of reduced iron powder by sieve and wind selection methods. (H11g, H11h; Fe)

16-H. Powder Metallurgy—VI. J. F. C. Morden. *Metal Industry,* v. 90, Jan. 1957, p. 23-25.

Compacting by hot pressing, rolling and extrusion. 8 ref. (H14)

17-H. Development of Titanium Alloy Powder Production. G. F. Davies.

U. S. Watertown Arsenal Laboratory, Report 401/120-23, Aug. 1953, 42 p. (PB 111918). Abstracted in *U. S. Government Research Reports,* v. 27, Feb. 15, 1957, p. 60. (CMA)

Preparation methods for titanium alloy powders are described and titanium powder scraps are evaluated. Scrap alloy may be used to produce powder by an attritioning method, by mechanical mutilation and the mercury technique, and by mechanically cutting massive scrap under mercury. (H10e; Ti)

18-H. (French.) **Quality Control of Powder Metal Items.** *La Machine Moderne,* Jan. 1957, p. 14-61.

Various quality control tests currently employed at the Yale and Towne Manufacturing Co. in the manufacture of powder metal items. Equipment used to test each stage of the manufacturing process. (H general, 1-4, 1-2)

19-H. (German.) **Phenomena Ocurring During Sintering of Metallic Materials.** R. Palme. *Metall,* v. 11, Jan. 1957. p. 8-9.

Basic processes are described for sintering one-phase metal powders with special emphasis on the influence of sintering temperature. Practical applications. Metal powder loss during sintering process is explained. 7 ref. (H15n, 2-11)

J Heat Treatment

36-J. Carbonitride to Step Up Powder Iron Properties. Lars Troberg. *Iron Age,* v. 179, Jan. 10, 1957, p. 66-68.

Carburizing has limited usefulness for powder iron parts. Where higher hardness and hardenability are called for, carbonitriding is a helpful tool. (J28m; Fe, 6-22)

37-J. Complex Heat Patterns Flame-Harden Part. *Iron Age,* v. 179, Jan. 17, 1957, p. 83.

Apparatus for flame-hardening of hyperbolic roller part. (J2h, 1-2)

38-J. Effect of Nitrogen on Hardenability in Boron Steels. John C. Shyne and Eric R. Morgan. *Journal of Metals,* v. 9, Jan. 1957, p. 116, 117.

Theories and effects on hardenability of boron and nitrogen and their interaction in steel. 5 ref. (J5, AY, *B, N*)

39-J. Use of Isothermal Heat Treatments in France. Georges Stempfel. *Metal Progress,* v. 71, Jan. 1957, p. 100-102.

The lack of free interchange of technical information during World War II retarded the development and use of isothermal treatments in France but they are now in widespread use. (J26p, J2j; CN, AY, TS)

40-J. Induction Heating for Stress-Relieving Large Steel Cylinders. G. W. Seulen. *Metal Progress,* v. 71, Jan. 1957, p. 126-130.

Portable equipment in 100-kw. packages, converting line frequencies to 2000 or 10,000-cycle current, can efficiently and accurately heat treat welded seams in pipe and pressure vessels using built-up inductors (water cooled) or uncooled copper cable. (J1a, J2g, 1-2; ST, 7-1)

41-J. The Application of Induction Heating to the Surface Hardening of Steel. J. Hamilton. *Metallurgia,* v. 55, Jan. 1957, p. 3-7.

Outline of the principles of induction heating. Discussion of practical applications and types of generator available. Description of some typical installations. (J2g, 1-2; ST)

42-J. Rapid Quenching With Reduced Distortion. Robert F. Lutz. *Tooling and Production,* v. 22, Jan. 1957, p. 79-82.

An automatic batch-type furnace and Voluta 23 quenching oil permits heat treatment of variety of axle and gear parts. (J26n, W27, 1-2)

43-J. The Effect of Grain Size on the Mechanical Properties of Ferritic Nodular Irons. G. N. J. Gilbert. *British Cast Iron Research Association, Journal of Research and Development,* v. 6, Dec. 1956, p. 430-435.

Two-stage ferritizing anneal, consisting of heating at about 900° C. in the austenitic range and then at 690° C. below the critical range. Fine-grained materials have substantially increased proof stresses and are more ductile. (J23s, Q23p, 2-9; CI-r)

44-J. Qualitative Test for Si-Cr-W Shock Resisting Toolsteel. Sadao Koshiba, Kazno Tanaka and Tsuneo Kunou. *Hitachi Review,* v. 16, Nov. 1956, p. 19-21, 18.

Relation between the quenching temperature and hardness, tempering temperature and hardness. Hardenability, rate of deformation, mechanical properties at elevated temperatures. (J26, J29, J5, Q general, 2-12; TS-j)

45-J. Carbonitriding. J. Lomas. *Machinery, Lloyd,* v. 28, Dec. 22, 1956, p. 91.

Gas composition for carbonitriding and the relation of Rockwell hardness to carbon penetration depth in the steel surface. (J28m; ST)

46-J. Types of Furnace Atmospheres. Curtis H. Vaughan. *Metal Progress,* v. 71, Feb. 1957, p. 93-96.

Considers six basic sources for protective atmospheres, notes briefly their method of production, and variations in their constitution with variations in the operating equipment and the control settings. (J2k, B25; RM-g)

47-J. Instrumentation in the Heat Treatment of Steel. Part II—Importance of Instrumentation. W. F. Coxon. *Metal Treatment and Drop Forging,* v. 24, Jan. 1957, p. 7-10.

Method of controlling the important variables for successful heat treatment. (To be continued.) (J general, X general; ST)

48-J. Steel Heat Treating Highlights of 1956. Carl L. Ipsen. *Steel Processing,* v. 43, Jan. 1957, p. 17, 51.

Survey reports trends which include increasing automation, higher temperatures, greater use of controlled or protective atmospheres and more precise controls and instruments. (J general)

49-J. Investigation of Stress Relief Procedures for Titanium and Titanium Alloys. F. J. Gillig. *U.S. Air Force, Wright Air Development Center, Technical Report 55-510,* Aug. 1956, 82 p. (PB 1216570). Abstracted in *U.S. Government Research Reports,* v. 27, Jan. 18, 1957, p. 19. (CMA)

A critical examination of residual stresses in titanium aircraft parts includes discussion of the build-up of residual stress and the difference between macro and micro stresses. A means of thermally reducing the residual stresses was evolved and stress relief procedures are outlined. Strain relaxation tests were conducted with four titanium compositions. (J1a, Q25h; Ti)

50-J. A Study of the Mechanisms of Heat Treatment of Zirconium-Base Alloys. Status Report for July 1, 1955-Feb. 29, 1956. R. F. Domagala, et al. *U.S. Atomic Energy Commission AECU-3191,* Mar. 1956, 9 p. (CMA)

Variation of mechanical properties studied in the course of establishing the transformation kinetics of zirconium binary alloys. Zr-Sn and Zr-Ti alloys, unsuitable for heat treatment, transform rapidly when quenched from the β field. Zr-Mo responds to heat treatment with variation of mechanical properties; embrittlement is attributed to the ω-phase. High hardness in Zr-Cb and Zr-Th has the same cause. (J general, N6p, Q general; Zr, *Ti, Mo, Cb,* Th)

51-J. A Study of the Short-Time Annealing of Cold Worked Zirconium. D. E. Johnson. *U.S. Atomic Energy Commission. HW-41372,* Feb. 29, 1956, 33 p. (CMA)

Short-time annealing of cold worked zirconium studied at 650, 700, 750, 800 and 825° C. for times ranging from 0.25 min. to 8 hr. Tensile properties and ductility were tested. A short anneal restores ductility in cold worked zirconium as effectively as the longer commercial anneals; 1 min. at 750° C. was best for 25% cold worked zirconium and 0.5 min. at 750° C. was best for 65% cold worked zirconium. Water quenches followed. Recrystallization is complete after 2 min. at 750° C. (J23, Q23p; Zr)

52-J. Heat Treatment of Carbon and Low Alloy Pressure-Vessel Steels. O. R. Carpenter and C. Floyd. *Welding Journal,* v. 36, Feb. 1957, p. 67s-76s.

Pressure vessel code interpretive report describes code requirements, recommended heat treatment practices and forming procedures for pressure-vessel steels. 13 ref. (J general, S22; CN, AY)

53-J. (Russian.) **Investigating the Recrystallization of Titanium and Its Alloys. 3. Effect of Annealing Temperature on the Mechanical Properties and Microstructure of Titanium.** Ye. M. Savitskiy and M. A. Tylkina. *Izvestiya Akademii Nauk SSSR, Otdelaniya Tekhnicheskikh Nauk,* no. 10, Oct. 1956, p. 125-127.

Studies the effect of annealing temperature in the range of 600-1300° C. on the structure and the mechanical properties of deformed titanium. Prior to tension and impact resistance tests, the iodic and magneothermic titanium specimens were annealed at 600, 700, 900, 1000, 1200 and 1300° C. for 1 hr. in evacuated quartz ampoules. Mechanical properties were found to be sensitive indices of structural changes in titanium resulting from heat treatment. The heating of all the tested titaniums to above 1000° C. always resulted in the preservation of the contours of beta-modification grains after cooling and a transition into the alpha prime form, and considerably decreases the mechanical and especially the plastic properties of titanium. (J23c, 2-11, N5; Ti)

54-J. (Book—German.) **Introduction to Annealing.** Wilhelm Ordinanz. 243 p. 1956. Carl Hanser Verlag, Kolbergerstr. 22, Muenchen 27, Germany.

Introduction to fundamentals and practice. Procedures, materials and their commercial application. Descriptions of modern heat treatment, particularly of steel. Exact instructions for different grades of steel. 69 ref. (J23; ST)

K Assembling and Joining

52-K. Brazed Stainless Sandwich Spotwelded. J. C. Herr, R. C. Smith, G. L. Peterman. *American Machinist,* v. 101, Jan. 14, 1957, p. 127-129.

Welding setup similar to those used for other stainless spot welds used to join brazed, honeycomb panels to supporting members. (K3n; SS, 7-9)

53-K. Weld Procedure. E. Ryalls and F. Warner. *British Welding Journal,* v. 4, Jan. 1957, p. 39.

Welding sequence of commercially pure aluminum by the argon-arc process. (K1d; Al)

54-K. Welding Costs Must Come Down. H. J. Nichols. *Canadian Metals,* v. 20, Jan. 1957, p. 24, 25.

Advantages and disadvantages from cost and application standpoints of manual welding and automatic process; trends, developments. (K general, 17-3)

55-K. How Heat and Time Affect Welding. A. C. Ward. *Iron Age,* v. 179, Jan. 17, 1957, p. 75-77.

Suggests by the use of metallurgical data how to anticipate and compensate for crystalline structure changes that occur as you weld. (K9n)

56-K. Hard-to-Braze Alloys Behave in Vacuum Setup. W. G. Patton. *Iron Age,* v. 179, Jan. 24, 1957, p. 80-82.

Vacuum furnace allows greater use of high-temperature alloys and critical materials, permits brazing of honeycomb tight structures, increases range of bonding alloys and allows vacuum degassing. (K8j, 1-23)

57-K. Symposium on Titanium IV. Practical Problems Associated With the Control of Interstitials I. In Welding and Forming. C. W. Handova. *Journal of Metals,* v. 9, Jan. 1957, p. 178-180. (CMA)

Much research has been accomplished on the effect of interstitials on ductility, impact properties and filler wire in welds of titanium. Most titanium alloys may be welded if the interstitial content is kept low; shielding is desirable. The weld bend ductility test is necessary. Interstitials are detrimental in forming, but hot forming can overcome their strengthening effect. Ease of forming titanium is related to the yield strength, as is springback. Pickle baths are recommended. 19 ref. (K1, G general, 3-19; Ti)

58-K. Welded Aluminium Piping. *Light Metals,* v. 20, Jan. 1957, p. 20-27.

Welding equipment and its operation in a tubemaking plant. (K general, 1-2; Al, 4-10)

59-K. Use of Adhesives for Metal Joining in Germany. A. Matting and E. Rubo. *Metal Progress,* v. 71, Jan. 1957, p. 95-98.

Adhesives are not yet used for highly stressed metal-to-metal joints in Germany but their use is increasing as more engineering information about their behavior is obtained. (K12)

60-K. Three Ways to Cut Brazing Costs. Ralph Raidy. *Steel,* v. 140, Jan. 21, 1957, p. 73-74.

Maker of tubular steel assemblies reduces cost by change to silver brazing alloy, installing gas fired brazing machines and using vapor flux. (K8, 17-3)

61-K. Weld Penetration Characteristics of Atmosphere-Melted Versus Vacuum-Melted Zircaloy. S. A. Toftegaard, *U. S. Atomic Energy Commission. KAPL-MEMO-SAT-1,* Nov. 1, 1956, 8 p. (CMA)

A weld study was conducted to determine the variability of weld penetration in vacuum and inert gas-melted Zircaloy and to determine the effects of prior vacuum annealing and surface machining on penetration. An inert gas-melted material has superior penetration; surface machining is deleterious to weld penetration, and vacuum annealing somewhat so. (K9n, 3-20; Zr)

62-K. Hydraulic Pit Props. *Welding and Metal Fabrication,* v. 25, Jan. 1957, p. 2-5.

Quantity production of mine props achieved through series of simple operations using automatic arc welding machines for circular welds and manual welding for other operations. (K1, 18-24)

63-K. A Constant Potential Power Source for the Self-Adjusting Arc Welding of Aluminum and Its Alloys. J. G. Young. *Welding and Metal Fabrication,* v. 25, Jan. 1957, p. 6-8.

Experimental work with constant potential source indicates that calibration and settings for particular welding conditions are easier and arc control may be simplified. (K1, W29; Al)

64-K. Tubular Fabrication—Part 4. A. Scott. *Welding and Metal Fabrication,* v. 25, Jan. 1957, p. 30-32.

Diagrams, weld defects and causes. Suggests minimization of distortion by presetting for correction after welding. (K9p; 4-10, 9-24)

65-K. Welding Precipitation-Hardening Stainless Steels. George E. Linnert. *Welding Journal,* v. 36, Jan. 1957, p. 9-27.

Classification of grades by microstructure. Description of groups. 17-4PH, 17-7PH, and 17-10PH steels were studied as to welding behavior. 11 ref. (K general; SS)

66-K. Argon-Hydrogen Shielding-Gas Mixtures for Tungsten-Arc Welding. T. McElrath and E. F. Gorman. *Welding Journal,* v. 36, Jan. 1957, p. 28-35.

Smooth clean welds, more fluid puddle, longer electrode life and faster weld speeds can be obtained with argon-hydrogen mixtures than with argon or helium. Unsatisfactory for welding aluminum, copper and carbon steel and will not work with certain techniques. (K1d; SS, Ni)

67-K. Coating Ingredients' Influence on Surface Tension, Arc Stability and Bead Shape. T. H. Hazlett. *Welding Journal,* v. 36, Jan. 1957, p. 18s-22s.

Attempt made to isolate and determine the effects of a number of the important compounds currently used in the manufacture of commercial welding electrodes. 5 ref. (K1a, W29)

68-K. Metal Transfer Characteristics in Gas-Shielded Arc Welding. H. C. Ludwig. *Welding Journal,* v. 36, Jan. 1957, p. 23s-26s.

Conventional inert-gas-shielded consumable-electrode type welding equipment was used. A high speed camera with speed of 7000 frames/sec was used. Author suggests that major force component causing metallic drop ejection from the electrode is electromagnetic action. 7 ref. (K1d, X5)

69-K. The Weaving of Spring Steel Wires. A. Jasper. *Wire,* Dec. 1956, p. 38-41.

Wire thickness and mesh width; weaving with shuttles; capacity of loom as affected by use of spring steel wires and mesh assembling looms. (K13s; ST, SGA-b, 4-11)

70-K. (English.) Welding of Steel With Consumable Electrodes Under a Shield of Carbon Dioxide. E. Sellier. *Acier-Stahl-Steel,* v. 21, Dec. 1956, p. 489-492.

Carbon-shielded welding with consumable electrodes is cheaper than and presents no manufacturing difficulties over the argon-shielded process. (K1d; ST)

71-K. Blind Riveting: New Type of Mandrel-Expanded Rivet With Sealed End. *Aircraft Production,* v. 19, Jan. 1957, p. 42.

A completely airtight and watertight joint is produced and the mandrel is completely enclosed. (K13n)

72-K. Welding for the Sawdoctor: Remarkable Achievements With Oxy-Welding. J. D. English. *Australasian Engineer,* v. 49, Nov. 7, 1956, p. 62-63.

Recent advances in welding saws. (K2h)

73-K. How to Weld Aluminum Bus. *Electrical World,* v. 147, Jan. 14, 1957, p. 60-61.

Gas welding compared with electrical welding; heat zone, welding speed; use of helium and argon. (K1, K2; Al, SGA-q)

74-K. Welding in the United States: Various Processes Compared. *Engineering,* v. 182, Dec. 21, 1956, p. 779-780.

Shielded-arc welding, resistance welding; testing welds. (K1, K3, K9r)

75-K. Complete Inert Gas Shield Is Key to Successful Zirconium Welding. G. E. Elder, et al. *Industry and Welding,* v. 30, Feb. 1957, p. 52-56, 58, 61, 87. (CMA)

Welding operations performed on Zircaloy core tanks described. Inert gas shielding is necessary. Fabricated parts were chosen for welding rather than forged parts and the number of welds were minimized. All welding was done in the downhand position. Inspection was accomplished by ultrasonic and radiographic means. (K1d; Zr)

76-K. Weld Stainless With Submerged Arc. W. E. McFee. *Industry and Welding,* v. 30, Feb. 1957, p. 64-66, 89.

Properly adjusted submerged arc provides protection while welding stainless. (K1e; SS)

77-K. Five Points to Remember When You Arc Weld Copper Alloys. *Industry and Welding,* v. 30, Feb. 1957, p. 71-77.

Suggested procedures include use of coated electrodes, careful cleaning, high preheat and downhand welding. (K1; Cu)

78-K. Resistance Welding Applied to Airframe Construction. N. K. Gardner. *Machinery,* v. 90, Jan. 25, 1957, p. 210-214.

Examples of the use of spot and seam welding; types of welding machines in use; procedures adopted to ensure high standard of weld efficiency; applications of flash butt welding. (K3, T24a)

79-K. Welding and Brazing the Newer Metals. F. G. Cox. *Metal Progress,* v. 71, Jan. 1957, p. 204, 206, 208. Digest of article from *Murex Ltd. Review,* v. 1, 1956, p. 429-463. (CMA)

Use of the fabricated part is the major consideration in selecting joining method for zirconium, molybdenum and other refractory metals. Sheet thickness is an important criterion for most methods. Argon or vacuum is necessary for brazing. (K general; Zr, Mo)

80-K. The Development of the Science and Technique of Arc Welding in the U.S.S.R. N. N. Rykalin. *Sheet Metals Industries,* v. 14, Jan. 1957, p. 35-40.

Automatic arc welding, automatic welding units, welding fluxes, electric slag welding, gas-shielded arc welding, use of alternating current and research work. (K1)

81-K. A Metallurgist Looks at Flash Welding. Hiram Brown. *Steel,* v. 140, Jan. 28, 1957, p. 90-91.

Suggestions by a metallurgist for testing and improving flash buttwelds. (K3r)

82-K. Try Carbide Bonding With a No-Mix Epoxy. Bernard Gould. *Tooling and Production,* v. 22, Feb. 1957, p. 79-84.

Development of a single-component epoxy paste adhesive providing a nonflowing, low-heat "chemical fastener" eliminating distortion and embrittlement in the critical joining of dissimilar materials. (K12)

83-K. Production of Sound Ductile Joints in Molybdenum. M. I. Jacobson, D. C. Martin and C. B. Voldrich. *U.S. Air Force, Wright Air Development Center, Technical Report 53-401,* Jan. 1954, 72 p. (PB 123916) Abstracted in *U.S. Government Research Reports,* v. 27, Jan. 18, 1957, p. 21. (CMA)

Welding and brazing methods for molybdenum were studied and results are reported for tungsten-arc welding and induction brazing tests. Although weldments were ductile longitudinally they were brittle transversely to the welding direction because of recrystallization. The brazing alloys giving best results were Inconel and Haynes Alloy 25. (K1, K8k, Mo, SGA-f)

84-K. Inert Tungsten-Arc Welding of S3G Zircaloy Channel Sections. S. A. Toftegaard. *U.S. Atomic Energy Commission. KAPL-M-SAT-2,* Nov. 14, 1956, 7 p. (CMA)

A joint design was developed for Zircaloy-2 weldments which gave the desired contour for inert tungsten-arc welding; full penetration was achieved without drop-through in a single pass. Addition of filler metal was unnecessary. (K1d; Zr)

85-K. Research and Development for the Welding of Titanium and Titanium Alloys. J. J. Chyle and I. Kutuchief. *U.S. Watertown Arsenal Laboratory, Report 401/89-16,* April 1954, 79 p. (PB 111849). Abstracted in *U.S. Government Research Reports,* v. 27, Feb. 15, 1957, p. 61. (CMA)

Welding tests were conducted on titanium alloys containing manganese, chromium, iron, aluminum and molybdenum; filler metal in the form of strips was removed from the parent plate. The sigma method was employed, using helium and a thoriated grade of tungsten electrode. (K1d; Ti)

86-K. Weldability of Three Ferritic Chromium-Molybdenum Bearing Steels. B. Trehearne. *Welding and Metal Fabrication,* v. 25, Feb. 1957, p. 48-52.

Three ferritic creep-resisting, medium high-temperature service steels examined to determine satisfactory welding conditions: (a) 1% Cr, ½% Mo, (b) 4-6% Cr, ½% Mo, (c) 2¼% Cr, 1% Mo. Controlled thermal severity tests on (a) and (b). 9 ref. (K9s; Ay)

87-K. Aspects of the New Monel and Nickel Arc-Welding Electrodes. F. A. Ball and D. R. Thorneycroft. *Welding and Metal Fabrication,* v. 25, Feb. 1957, p. 59-64.

Welding overlays on mild steel, welding clad steels, welding solid nickel and Monel; hot-cracking tests, hardness of the weld metal, analysis and microstructure. (K1g, W29; Ni)

88-K. Resistance Welding—the Past and Present. Jack Fairlie. *Welding Engineer,* v. 42, Jan. 1957, p. 20-23.

Summary of developments since 1877 when Thompson perfected the resistance welder. (K3)

89-K. Arc Welding Defined: Learning to Work With Weldability. Bela M. Ronay. *Welding Engineer,* v. 42, Jan. 1957, p. 26-28.

Weldability is determined by expansion and contraction curves on heating and cooling and ductility at all temperatures during cooling. (K9s, K1)

90-K. These Six Steps Are the Secret to Good Silver-Brazed Joints. *Welding Engineer,* v. 41, Dec. 1956, p. 28-29.

Steps include: good fit and clean metal, proper fluxing, use of supporting parts, proper heating, and final cleaning. (K8; *Ag*)

91-K. "How to Do It" With an Oxy-Acetylene Torch. T. B. Jefferson. *Welding Engineer,* v. 42, Jan. 1957, p. 32-34.

Joint preparation and correct procedure in oxy-acetylene welding. (K2h)

92-K. Filler Metals for Joining. Orville T. Barnett. *Welding Engineer,* v. 41, Dec. 1956, p. 54-60.

Deposition characteristics and mechanical properties of manual arc welds using iron powder electrodes of several types. (K1, 1-2; *Fe,* 6-18)

93-K. Welding of High-Strength Pressure Vessel Steels in Heavy Sections. A. P. Bunk. *Welding Journal,* v. 36, Feb. 1957, p. 62s-66s.

Welding procedure qualification tests developed for 4-in. thick plates in accordance with ASME requirements; results for A201 A steel, A302 grade B steel, Ni-Cu-Mo-V steel and Mn-Ni-Cr-Cu-Mo-V steel. (K9r; SGB-a, 4-3)

94-K. Roll Planishing Improves Weld-Joint Efficiency and Quality. H. L. Meredith and B. R. Russell. *Welding Journal,* v. 36, Feb. 1957, p. 113-117.

Factors causing loss in weld-joint strength, effect of cold working sheet metal, roll planishing, effect of weld size; weld shrinkage and tensile strength of planished weld. (K9q, Q27a)

95-K. Study of Interrupted Welding of Heavy-Wall Steam Pipe. I. A. Rohrig, J. O. Smith and E. G. Shifrin. *Welding Journal,* v. 36, Feb. 1957, p. 128-131.

Alloy steel pipe (2¼% Cr, 1% Mo) in wall thickness up to ¾ in. can safely be welded with interrupted heat cycles if proper precautions are exercised. (K1; AY, 4-10)

96-K. Hydrogen vs. Acetylene vs. Inert Gas in Welding Aluminum Alloys. J. Koziarski. *Welding Journal,* v. 36, Feb. 1957, p. 141-148.

Investigations concerned primarily with type, amount and location of porosity and fusion obtained with these methods of welding. 16 ref. (K1d, K2h, K2j, 9-18; Al)

97-K. Soldering Fluxes and Flux Principles. A. Z. Mample. *Western Union Technical Review,* v. 11, Jan. 1957, p. 35-42.

Thermal and mechanical considerations, flux corrosion and its conductivities, self-neutralizing fluxes; fluxes from the point of view of metallurgy. 7 ref. (K7; RM-q)

98-K. (French.) **The Bonding of Light Metals.** J. J. Meynis de Paulin. *Chimie et Industrie,* v. 76, Dec. 1956, p. 1276-1290.

Survey of the principal adhesives available in France for the warm and cold bonding of metals, with special reference to the heat setting phenolic-vinylic, acrylonitrile-phenolic and ethoxylic glues. (K12)

99-K. (German.) **The Railway Bridge Over the Grand Emme Near Luterbach.** M. H. Gut. *Zeitschrift für Schweisstechnik,* v. 47, Jan. 1957, p. 2-10.

A completely welded steel bridge is described. Selection of materials, testing methods and the construction of the bridge. 4 ref. (K general, T26p)

100-K. (German.) **Brazing of Bicycle Parts at the "Allegro" Company.** E. W. Plüss. *Zeitschrift für Schweisstechnik,* v. 47, Jan. 1957, p. 11-12.

All parts involved are heated in a combustion chamber slightly above the melting temperature of the brass solder by means of an oil burner. The brass solder is introduced in form of a wire. (K8j)

101-K. (Russian.) **Manufacturing Welded Rotors From Austenitic Steel.** V. A. Toropov and G. I. Mart'yanov. *Energomashinostrovenive,* no. 11, Nov. 1956, p. 18-20.

The technological process of the welding and heat treatment of turbine rotors made of austenitic steel, guaranteeing low radial and axial deformation of the rotor. (K general, J general, T7; SS-e)

102-K. (Russian.) **Soldering of Aluminum and Its Alloys With the Use of Ultrasonics.** G. I. Apukhtin. *Informatsiya O Nauchno-Issledovatel' skikh Rabotakh,* No. I-56-3, Moscow, 1956.

New method for soldering aluminum and its alloys with the aid of ultrasonics, in which mechanical cleansing of the surfaces is supplanted by the phenomena of cavitation in the fused solder, produced by ultrasonic vibrations in the soldering iron tip. Generation of the vibrations is accomplished by means of magnetostriction vibrators. The system, apparatus, methods, and application are described. The method may be adapted to ferrous and nonferrous metals. (K7h, 1-2; Al)

103-K. (Spanish.) **Benefits Derived From the Use of Welding in Japan.** Akira Turuta and Iwao Onisi. *Ciencia y Técnica de la Soldadura,* v. 6, Sept.-Oct. 1956, 13 p.

Welding applications in construction and industry; examples of new ideas and production methods. Welding, oxygen cutting and allied techniques becoming widely used. Detail of calculations and procedures used to weld large spherical storage chambers, using tank of water as positioner. (K general)

104-K. (Spanish.) **Chemical Factors Affecting the Weldability of Low-Carbon Structural Steels.** J. M. Sistiaga. *Ciencia y Técnica de la Soldadura,* v. 6, July-Aug. 1956, 9 p.

Factors that affect quality of welded joints; cracking, porosity and brittleness; influence of chemical composition of materials used, with special consideration of hydrogen and silicon. 14 ref.
(K9s, 2-10; CN-g)

105-K. (Spanish.) **The Largest High-Pressure Spherical Gasometer in the World.** August Klönne. *Ciencia y Técnica de la Soldadura,* v. 6, Sept.-Oct. 1956, 6 p.

Procedures used in construction entirely by welding of 100,000 cubic meter capacity gasometer in Cologne, Germany. (K general, T26)

106-K. (Spanish.) **Production Advantages Attained by the Use of Automatic Arc Welding.** E. A. Gill. *Ciencia y Técnica de la Soldadura,* v. 6, Sept.-Oct. 1956, 7 p.

Advantages of automatic welding equipment in both large and small-scale production; importance of production planning, proper equipment, work procedures; measurement of productivity; description of automatic equipment; comparison of manual and automatic arc welding speeds. (K1, 18-24)

107-K (Spanish.) **Production Advantages of Electric Resistance Welding in the Manufacture of Home Refrigerators, Bicycles, Steel Containers and Storage Batteries.** R. Negro Parraga. *Ciencia y Técnica de la Soldadura,* v. 6, July-Aug. 1956, 15 p.

Water cooling of welding equipment, selection of electrodes, voltage, current and duration of operation, with practical rules for obtaining wood welds. Equipment employed, shop practice and controls realized in average size plants manufacturing above products. (K3; ST)

108-K. (Spanish.) **A Quantitative Production Control Procedure for Welding Work.** R. Rein Carso. *Ciencia y Técnica de la Soldadura,* v. 6, July-Aug. 1956, 5 p.

Two methods of determining work performed by welder: (1) direct measurement of work turned out, (2) check of work by number of electrodes used up; problems encountered in use of each method. Control forms shown.
(K general, A5d)

109-K. (Spanish.) **Repair of Engine Frame and Head of a Tractor by Means of Welding.** O. Zabara. *Ciencia y Técnica de la Soldadura,* v. 6, July-Aug. 1956, 2 p.

Done by cold arc welding with special low-melting point electrodes. Continuous current and inverted polarity used to avoid overheating of the work. (K1, 1-17, 18-22)

110-K. (Spanish.) **Study on the Joining of Copper Cables by Means of Welding.** Oleh Zabara. *Ciencia y Técnica de la Soldadura,* v. 6, Sept.-Oct. 1956, 3 p.

Electric welding with argon-protected arc so as not to modify conductivity of cables and in order to avoid electrolytic phenomena in grounds. (K1d, X15; Cu)

111-K. (Spanish.) **The Use of Welding in Building a Ship.** A. Pérez A. Quinones and F. Alonso Garcia. *Ciencia y Técnica de la Soldadura,* v. 6, July-Aug. 1956, 4 p.

Study of best way to prefabricate a given type of ship; comparison of welds made in horizontal and vertical positions in order to find relation between cost of vertical seams of prefabricated sections; determination of relation between assembly cost and size of sections for typical ship, in order to determine the most suitable prefabricated section in each case. (K general, T22)

112-K. (Spanish.) **Welding.** *Ciencia y Técnica de la Soldadura,* v. 6, July-Aug. 1956, 12 p.; Sept.-Oct. 1956, 6 p.

Electric arc welding. (To be continued.) (K1)

Cleaning Coating and Finishing

63-L. Pickling of Stainless Steel. *American Machinist,* v. 101, Jan. 14, 1957, p. 145.

Procedures and five different pickling solutions. (L12g; SS)

64-L. Ceramic Coating of Molybdenum Offers High Temperature Uses. *Aviation Week,* v. 66, Jan. 14, 1957, p. 75. (CMA)

Elraco Engineering Co. (Hoboken) has a "hot-coining" process for producing a protective ceramic coat on molybdenum which permits sufficient ductility to operate in a gas turbine. The pressed molybdenum powder preform is dipped in a liquid ceramic and then heated to 2350° F. The coated part, still hot, is then swaged, causing a forced diffusion of the ceramic into the metal. Final "uncoined" ceramic is baked on afterward to bridge any discontinuities. The process, still in the laboratory stage, was developed in cooperation with the Powder Metallurgical Laboratory of Stevens Institute.
(L27; Mo)

65-L. Enameling of Zirconium. J. Schultz, et al. *Chemical Engineering Progress Symposium Series,* no. 19, 1956, p. 99-104. (CMA)

Enamels for zirconium were developed which matured either below or above the zirconium transformation point. They were adherent, craze-free, and had low thermal-neutron-absorption cross sections. Frits were based on the $BbO\text{-}SiO_2$ system. The rolled zirconium tends to cause crazing in the enamel because of nonuniform contraction on cooling; the crazing tendency is eliminated by a heat treatment. The enamel confers oxidation resistance in air for 1000 hr. at 600° C., and resistance to molten lead at 345° C. and liquid bismuth at 600° C.
(L27; Zr)

66-L. Chemical Surface Preparation of Steel Prior to Painting. H. E. Patterson. *Corrosion,* v. 13, Jan. 1957, p. 77-84.

Advantages and disadvantages of various types of cleaning. Methods include solvent cleaning, alkali cleaning, emulsified solvent cleaning, steam cleaning, and acid cleaning. Also included are pickling, treating of pickled metal, use of inhibitors in pickling, and use of phosphate coatings. (L12; ST)

67-L. Red Lead in the Protection of Iron and Steel (3). H. Masseille. *Corrosion Protection & Control,* v. 3, Dec. 1956, p. 42-44; disc., p. 52.

Characteristics of red lead coating and application to ships.
(L26c; ST, CI, *Pb*)

68-L. Metallic Lead Pigment for Marine Anticorrosion Paints (2). J. R. Surridge. *Corrosion Prevention & Control,* v. 3, Dec. 1956, p. 49-52.

Uses and advantages of metallic lead paints. 2 ref. (L26n, R4)

69-L. New Line Plates Contoured Parts With Few Rejects. Herbert Chase. *Iron Age,* v. 179, Jan. 10, 1957, p. 64-65.

Procedure for successfully plating zinc alloy die castings with copper, nickel and chromium in single line. Method gives less than 2% rejects.
(L17; Zn, *Al, Ni, Cr,* 5-11)

70-L. Can Sealers Fill Your Fabricating Needs? R. K. Humke. *Iron Age,* v. 179, Jan. 17, 1957, p. 84-86.

Elastomers and synthetic resins for sealers against water, air, dust, oils—their applications and characteristics. (L26p, L26r, K12; NM-d)

71-L. Grit Blasting: An Aid to Carburizing Quality. A. J. Schwarzkopf. *Iron Age,* v. 179, Jan. 24, 1957, p. 71-72.

Surface appearance of complex parts following grit blasting gives visual indication of decarburization and case leakage.
(L10c, Q29, J4a; ST)

72-L. Protecting Steelwork. *Iron and Steel,* v. 30, Jan. 1957, p. 31-32.

Coke plant protects steel from corrosive conditions by special multi-coat paints and coatings.
(L26n, W15; ST)

73-L. Technical Developments of 1956. Nathaniel Hall. *Metal Finishing,* v. 55, Jan. 1957, p. 42-52A.

Review of the literature on cleaning, pickling and polishing of metal surfaces, metallic coatings, electroforming, conversion films and waste treatment. 421 ref. (L general)

74-L. Automatic Plating of Zinc Die Castings. Ernest W. Horvick. *Metal Finishing,* v. 55, Jan. 1957, p. 52-55B.

Automobile and appliance uses for chromium, copper and gold plated zinc die castings. Modernization and automation of plating plants.
(L17, 18-24, Zn, 5-11, *Cr, Cu, Au*)

75-L. Electroless Arsenic-Zinc Alloy. Harry J. West. *Metal Finishing,* v. 55, Jan. 1957, p. 56.

Temperature, chemical composition of electrolyte; uses of this type of plating. (L28; As, Zn)

76-L. Cleaning of Lead Anodes for Chromium Plating. L. Missel. *Metal Finishing,* v. 55, Jan. 1957, p. 56, 58.

Chemical composition of electrolyte; soaking methods.
(L12, L17; *Cr*)

77-L. Chromium Plating From the Trivalent Bath. Melvin R. Zell. *Metal Finishing,* v. 55, Jan. 1957, p. 57-58.

Formamide addition to the plating solution and the operating conditions. 5 ref. (L17a; *Cr*)

78-L. Science for Electroplaters. 20. Polarization II. L. Serota. *Metal Finishing,* v. 55, Jan. 1957, p. 59-62.

Metal deposition, overvoltages of hydrogen and of metal, simultaneous deposition of two metals, polarization cells and the Haring cell.
(L17, N12d)

79-L. Mechanical Finishing of Precision Parts. L. H. Hopewell. *Plating,* v. 44, Jan. 1957, p. 36-39.

Discussion of automatic barrel finishing equipment. (L10d)

80-L. Barrel Finishing With Steel Balls and Shapes. C. B. Schaefer and R. G. Messenger. *Plating,* v. 44, Jan. 1957, p. 40-42.

Equipment and application.
(L10d, 1-2)

81-L. Preparation for Electroplating With Coated Abrasives. Warren K. Seward. *Plating,* v. 44, Jan. 1957, p. 43-46.

79-K. Welding and Brazing the Newer Metals. F. G. Cox. *Metal Progress,* v. 71, Jan. 1957, p. 204, 206, 208. Digest of article from *Murex Ltd. Review,* v. 1, 1956, p. 429-463. (CMA)

Use of the fabricated part is the major consideration in selecting joining method for zirconium, molybdenum and other refractory metals. Sheet thickness is an important criterion for most methods. Argon or vacuum is necessary for brazing. (K general; Zr, Mo)

80-K. The Development of the Science and Technique of Arc Welding in the U.S.S.R. N. N. Rykalin. *Sheet Metals Industries,* v. 14, Jan. 1957, p. 35-40.

Automatic arc welding, automatic welding units, welding fluxes, electric slag welding, gas-shielded arc welding, use of alternating current and research work. (K1)

81-K. A Metallurgist Looks at Flash Welding. Hiram Brown. *Steel,* v. 140, Jan. 28, 1957, p. 90-91.

Suggestions by a metallurgist for testing and improving flash buttwelds. (K3r)

82-K. Try Carbide Bonding With a No-Mix Epoxy. Bernard Gould. *Tooling and Production,* v. 22, Feb. 1957, p. 79-84.

Development of a single-component epoxy paste adhesive providing a nonflowing, low-heat "chemical fastener" eliminating distortion and embrittlement in the critical joining of dissimilar materials. (K12)

83-K. Production of Sound Ductile Joints in Molybdenum. M. I. Jacobson, D. C. Martin and C. B. Voldrich. *U.S. Air Force, Wright Air Development Center, Technical Report 53-401,* Jan. 1954, 72 p. (PB 123916) Abstracted in *U.S. Government Research Reports,* v. 27, Jan. 18, 1957, p. 21. (CMA)

Welding and brazing methods for molybdenum were studied and results are reported for tungsten-arc welding and induction brazing tests. Although weldments were ductile longitudinally they were brittle transversely to the welding direction because of recrystallization. The brazing alloys giving best results were Inconel and Haynes Alloy 25. (K1, K8k, Mo, SGA-f)

84-K. Inert Tungsten-Arc Welding of S3G Zircaloy Channel Sections. S. A. Toftegaard. *U.S. Atomic Energy Commission. KAPL-M-SAT-2,* Nov. 14, 1956, 7 p. (CMA)

A joint design was developed for Zircaloy-2 weldments which gave the desired contour for inert tungsten-arc welding; full penetration was achieved without drop-through in a single pass. Addition of filler metal was unnecessary. (K1d; Zr)

85-K. Research and Development for the Welding of Titanium and Titanium Alloys. J. J. Chyle and I. Kutuchief. *U.S. Watertown Arsenal Laboratory, Report 401/89-16,* April 1954, 79 p. (PB 111849). Abstracted in *U.S. Government Research Reports,* v. 27, Feb. 15, 1957, p. 61. (CMA)

Welding tests were conducted on titanium alloys containing manganese, chromium, iron, aluminum and molybdenum; filler metal in the form of strips was removed from the parent plate. The sigma method was employed, using helium and a thoriated grade of tungsten electrode. (K1d; Ti)

86-K. Weldability of Three Ferritic Chromium-Molybdenum Bearing Steels. B. Trehearne. *Welding and Metal Fabrication,* v. 25, Feb. 1957, p. 48-52.

Three ferritic creep-resisting, medium high-temperature service steels examined to determine satisfactory welding conditions: (a) 1% Cr, ½% Mo, (b) 4-6% Cr, ½% Mo, (c) 2¼% Cr, 1% Mo. Controlled thermal severity tests on (a) and (b). 9 ref. (K9s; Ay)

87-K. Aspects of the New Monel and Nickel Arc-Welding Electrodes. F. A. Ball and D. R. Thorneycroft. *Welding and Metal Fabrication,* v. 25, Feb. 1957, p. 59-64.

Welding overlays on mild steel, welding clad steels, welding solid nickel and Monel; hot-cracking tests, hardness of the weld metal, analysis and microstructure. (K1g, W29; Ni)

88-K. Resistance Welding—the Past and Present. Jack Fairlie. *Welding Engineer,* v. 42, Jan. 1957, p. 20-23.

Summary of developments since 1877 when Thompson perfected the resistance welder. (K3)

89-K. Arc Welding Defined: Learning to Work With Weldability. Bela M. Ronay. *Welding Engineer,* v. 42, Jan. 1957, p. 26-28.

Weldability is determined by expansion and contraction curves on heating and cooling and ductility at all temperatures during cooling. (K9s, K1)

90-K. These Six Steps Are the Secret to Good Silver-Brazed Joints. *Welding Engineer,* v. 41, Dec. 1956, p. 28-29.

Steps include: good fit and clean metal, proper fluxing, use of supporting parts, proper heating, and final cleaning. (K8; *Ag*)

91-K. "How to Do It" With an Oxy-Acetylene Torch. T. B. Jefferson. *Welding Engineer,* v. 42, Jan. 1957, p. 32-34.

Joint preparation and correct procedure in oxy-acetylene welding. (K2h)

92-K. Filler Metals for Joining. Orville T. Barnett. *Welding Engineer,* v. 41, Dec. 1956, p. 54-60.

Deposition characteristics and mechanical properties of manual arc welds using iron powder electrodes of several types. (K1, 1-2; *Fe,* 6-18)

93-K. Welding of High-Strength Pressure Vessel Steels in Heavy Sections. A. P. Bunk. *Welding Journal,* v. 36, Feb. 1957, p. 62s-66s.

Welding procedure qualification tests developed for 4-in. thick plates in accordance with ASME requirements; results for A201 A steel, A302 grade B steel, Ni-Cu-Mo-V steel and Mn-Ni-Cr-Cu-Mo-V steel. (K9r; SGB-a, 4-3)

94-K. Roll Planishing Improves Weld-Joint Efficiency and Quality. H. L. Meredith and B. R. Russell. *Welding Journal,* v. 36, Feb. 1957, p. 113-117.

Factors causing loss in weld-joint strength, effect of cold working sheet metal, roll planishing, effect of weld size; weld shrinkage and tensile strength of planished weld. (K9q, Q27a)

95-K. Study of Interrupted Welding of Heavy-Wall Steam Pipe. I. A. Rohrig, J. O. Smith and E. G. Shifrin. *Welding Journal,* v. 36, Feb. 1957, p. 128-131.

Alloy steel pipe (2¼% Cr, 1% Mo) in wall thickness up to ¾ in. can safely be welded with interrupted heat cycles if proper precautions are exercised. (K1; AY, 4-10)

96-K. Hydrogen vs. Acetylene vs. Inert Gas in Welding Aluminum Alloys. J. Koziarski. *Welding Journal,* v. 36, Feb. 1957, p. 141-148.

Investigations concerned primarily with type, amount and location of porosity and fusion obtained with these methods of welding. 16 ref. (K1d, K2h, K2j, 9-18; Al)

97-K. Soldering Fluxes and Flux Principles. A. Z. Mample. *Western Union Technical Review,* v. 11, Jan. 1957, p. 35-42.

Thermal and mechanical considerations, flux corrosion and its conductivities, self-neutralizing fluxes; fluxes from the point of view of metallurgy. 7 ref. (K7; RM-q)

98-K. (French.) **The Bonding of Light Metals.** J. J. Meynis de Paulin. *Chimie et Industrie,* v. 76, Dec. 1956, p. 1276-1290.

Survey of the principal adhesives available in France for the warm and cold bonding of metals, with special reference to the heat setting phenolic-vinylic, acrylonitrile-phenolic and ethoxylic glues. (K12)

99-K. (German.) **The Railway Bridge Over the Grand Emme Near Luterbach.** M. H. Gut. *Zeitschrift für Schweisstechnik,* v. 47, Jan. 1957, p. 2-10.

A completely welded steel bridge is described. Selection of materials, testing methods and the construction of the bridge. 4 ref. (K general, T26p)

100-K. (German.) **Brazing of Bicycle Parts at the "Allegro" Company.** E. W. Plüss. *Zeitschrift für Schweisstechnik,* v. 47, Jan. 1957, p. 11-12.

All parts involved are heated in a combustion chamber slightly above the melting temperature of the brass solder by means of an oil burner. The brass solder is introduced in form of a wire. (K8j)

101-K. (Russian.) **Manufacturing Welded Rotors From Austenitic Steel.** V. A. Toropov and G. I. Mart'yanov. *Energomashinostrovenive,* no. 11, Nov. 1956, p. 18-20.

The technological process of the welding and heat treatment of turbine rotors made of austenitic steel, guaranteeing low radial and axial deformation of the rotor. (K general, J general, T7; SS-e)

102-K. (Russian.) **Soldering of Aluminum and Its Alloys With the Use of Ultrasonics.** G. I. Apukhtin. *Informatsiya O Nauchno-Issledovatel' skikh Rabotakh,* No. I-56-3, Moscow, 1956.

New method for soldering aluminum and its alloys with the aid of ultrasonics, in which mechanical cleansing of the surfaces is supplanted by the phenomena of cavitation in the fused solder, produced by ultrasonic vibrations in the soldering iron tip. Generation of the vibrations is accomplished by means of magnetostriction vibrators. The system, apparatus, methods, and application are described. The method may be adapted to ferrous and nonferrous metals. (K7h, 1-2; Al)

103-K. (Spanish.) **Benefits Derived From the Use of Welding in Japan.** Akira Turuta and Iwao Onisi. *Ciencia y Técnica de la Soldadura,* v. 6, Sept.-Oct. 1956, 13 p.

Welding applications in construction and industry; examples of new ideas and production methods. Welding, oxygen cutting and allied techniques becoming widely used. Detail of calculations and procedures used to weld large spherical storage chambers, using tank of water as positioner. (K general)

104-K. (Spanish.) **Chemical Factors Affecting the Weldability of Low-Carbon Structural Steels.** J. M. Sistiaga. *Ciencia y Técnica de la Soldadura,* v. 6, July-Aug. 1956, 9 p.

Factors that affect quality of welded joints; cracking, porosity and brittleness; influence of chemical composition of materials used, with special consideration of hydrogen and silicon. 14 ref.
(K9s, 2-10; CN-g)

105-K. (Spanish.) **The Largest High-Pressure Spherical Gasometer in the World.** August Klönne. *Ciencia y Técnica de la Soldadura,* v. 6, Sept.-Oct. 1956, 6 p.

Procedures used in construction entirely by welding of 100,000 cubic meter capacity gasometer in Cologne, Germany. (K general, T26)

106-K. (Spanish.) **Production Advantages Attained by the Use of Automatic Arc Welding.** E. A. Gill. *Ciencia y Técnica de la Soldadura,* v. 6, Sept.-Oct. 1956, 7 p.

Advantages of automatic welding equipment in both large and small-scale production; importance of production planning, proper equipment, work procedures; measurement of productivity; description of automatic equipment; comparison of manual and automatic arc welding speeds. (K1, 18-24)

107-K (Spanish.) **Production Advantages of Electric Resistance Welding in the Manufacture of Home Refrigerators, Bicycles, Steel Containers and Storage Batteries.** R. Negro Parraga. *Ciencia y Técnica de la Soldadura,* v. 6, July-Aug. 1956, 15 p.

Water cooling of welding equipment, selection of electrodes, voltage, current and duration of operation, with practical rules for obtaining wood welds. Equipment employed, shop practice and controls realized in average size plants manufacturing above products. (K3; ST)

108-K. (Spanish.) **A Quantitative Production Control Procedure for Welding Work.** R. Rein Carso. *Ciencia y Técnica de la Soldadura,* v. 6, July-Aug. 1956, 5 p.

Two methods of determining work performed by welder: (1) direct measurement of work turned out, (2) check of work by number of electrodes used up; problems encountered in use of each method. Control forms shown.
(K general, A5d)

109-K. (Spanish.) **Repair of Engine Frame and Head of a Tractor by Means of Welding.** O. Zabara. *Ciencia y Técnica de la Soldadura,* v. 6, July-Aug. 1956, 2 p.

Done by cold arc welding with special low-melting point electrodes. Continuous current and inverted polarity used to avoid overheating of the work. (K1, 1-17, 18-22)

110-K. (Spanish.) **Study on the Joining of Copper Cables by Means of Welding.** Oleh Zabara. *Ciencia y Técnica de la Soldadura,* v. 6, Sept.-Oct. 1956, 3 p.

Electric welding with argon-protected arc so as not to modify conductivity of cables and in order to avoid electrolytic phenomena in grounds. (K1d, X15; Cu)

111-K. (Spanish.) **The Use of Welding in Building a Ship.** A. Pérez A. Quinones and F. Alonso Garcia. *Ciencia y Técnica de la Soldadura,* v. 6, July-Aug. 1956, 4 p.

Study of best way to prefabricate a given type of ship; comparison of welds made in horizontal and vertical positions in order to find relation between cost of vertical seams of prefabricated sections; determination of relation between assembly cost and size of sections for typical ship, in order to determine the most suitable prefabricated section in each case. (K general, T22)

112-K. (Spanish.) **Welding.** *Ciencia y Técnica de la Soldadura,* v. 6, July-Aug. 1956, 12 p.; Sept.-Oct. 1956, 6 p.

Electric arc welding. (To be continued.) (K1)

L Cleaning Coating and Finishing

63-L. Pickling of Stainless Steel. *American Machinist,* v. 101, Jan. 14, 1957, p. 145.

Procedures and five different pickling solutions. (L12g; SS)

64-L. Ceramic Coating of Molybdenum Offers High Temperature Uses. *Aviation Week,* v. 66, Jan. 14, 1957, p. 75. (CMA)

Elraco Engineering Co. (Hoboken) has a "hot-coining" process for producing a protective ceramic coat on molybdenum which permits sufficient ductility to operate in a gas turbine. The pressed molybdenum powder preform is dipped in a liquid ceramic and then heated to 2350° F. The coated part, still hot, is then swaged, causing a forced diffusion of the ceramic into the metal. Final "uncoined" ceramic is baked on afterward to bridge any discontinuities. The process, still in the laboratory stage, was developed in cooperation with the Powder Metallurgical Laboratory of Stevens Institute.
(L27; Mo)

65-L. Enameling of Zirconium. J. Schultz, et al. *Chemical Engineering Progress Symposium Series,* no. 19, 1956, p. 99-104. (CMA)

Enamels for zirconium were developed which matured either below or above the zirconium transformation point. They were adherent, craze-free, and had low thermal-neutron-absorption cross sections. Frits were based on the $BbO\text{-}SiO_2$ system. The rolled zirconium tends to cause crazing in the enamel because of nonuniform contraction on cooling; the crazing tendency is eliminated by a heat treatment. The enamel confers oxidation resistance in air for 1000 hr. at 600° C., and resistance to molten lead at 345° C. and liquid bismuth at 600° C.
(L27; Zr)

66-L. Chemical Surface Preparation of Steel Prior to Painting. H. E. Patterson. *Corrosion,* v. 13, Jan. 1957, p. 77-84.

Advantages and disadvantages of various types of cleaning. Methods include solvent cleaning, alkali cleaning, emulsified solvent cleaning, steam cleaning, and acid cleaning. Also included are pickling, treating of pickled metal, use of inhibitors in pickling, and use of phosphate coatings. (L12; ST)

67-L. Red Lead in the Protection of Iron and Steel (3). H. Masseille. *Corrosion Protection & Control,* v. 3, Dec. 1956, p. 42-44; disc., p. 52.

Characteristics of red lead coating and application to ships.
(L26c; ST, CI, *Pb*)

68-L. Metallic Lead Pigment for Marine Anticorrosion Paints (2). J. R. Surridge. *Corrosion Prevention & Control,* v. 3, Dec. 1956, p. 49-52.

Uses and advantages of metallic lead paints. 2 ref. (L26n, R4)

69-L. New Line Plates Contoured Parts With Few Rejects. Herbert Chase. *Iron Age,* v. 179, Jan. 10, 1957, p. 64-65.

Procedure for successfully plating zinc alloy die castings with copper, nickel and chromium in single line. Method gives less than 2% rejects.
(L17; Zn, *Al, Ni, Cr,* 5-11)

70-L. Can Sealers Fill Your Fabricating Needs? R. K. Humke. *Iron Age,* v. 179, Jan. 17, 1957, p. 84-86.

Elastomers and synthetic resins for sealers against water, air, dust, oils—their applications and characteristics. (L26p, L26r, K12; NM-d)

71-L. Grit Blasting: An Aid to Carburizing Quality. A. J. Schwarzkopf. *Iron Age,* v. 179, Jan. 24, 1957, p. 71-72.

Surface appearance of complex parts following grit blasting gives visual indication of decarburization and case leakage.
(L10c, Q29, J4a; ST)

72-L. Protecting Steelwork. *Iron and Steel,* v. 30, Jan. 1957, p. 31-32.

Coke plant protects steel from corrosive conditions by special multi-coat paints and coatings.
(L26n, W15; ST)

73-L. Technical Developments of 1956. Nathaniel Hall. *Metal Finishing,* v. 55, Jan. 1957, p. 42-52A.

Review of the literature on cleaning, pickling and polishing of metal surfaces, metallic coatings, electroforming, conversion films and waste treatment. 421 ref. (L general)

74-L. Automatic Plating of Zinc Die Castings. Ernest W. Horvick. *Metal Finishing,* v. 55, Jan. 1957, p. 52-55B.

Automobile and appliance uses for chromium, copper and gold plated zinc die castings. Modernization and automation of plating plants.
(L17, 18-24, Zn, 5-11, *Cr, Cu, Au*)

75-L. Electroless Arsenic-Zinc Alloy. Harry J. West. *Metal Finishing,* v. 55, Jan. 1957, p. 56.

Temperature, chemical composition of electrolyte; uses of this type of plating. (L28; As, Zn)

76-L. Cleaning of Lead Anodes for Chromium Plating. L. Missel. *Metal Finishing,* v. 55, Jan. 1957, p. 56, 58.

Chemical composition of electrolyte; soaking methods.
(L12, L17; *Cr*)

77-L. Chromium Plating From the Trivalent Bath. Melvin R. Zell. *Metal Finishing,* v. 55, Jan. 1957, p. 57-58.

Formamide addition to the plating solution and the operating conditions. 5 ref. (L17a; *Cr*)

78-L. Science for Electroplaters. 20. Polarization II. L. Serota. *Metal Finishing,* v. 55, Jan. 1957, p. 59-62.

Metal deposition, overvoltages of hydrogen and of metal, simultaneous deposition of two metals, polarization cells and the Haring cell.
(L17, N12d)

79-L. Mechanical Finishing of Precision Parts. L. H. Hopewell. *Plating,* v. 44, Jan. 1957, p. 36-39.

Discussion of automatic barrel finishing equipment. (L10d)

80-L. Barrel Finishing With Steel Balls and Shapes. C. B. Schaefer and R. G. Messenger. *Plating,* v. 44, Jan. 1957, p. 40-42.

Equipment and application.
(L10d, 1-2)

81-L. Preparation for Electroplating With Coated Abrasives. Warren K. Seward. *Plating,* v. 44, Jan. 1957, p. 43-46.

Methods of surface preparation. Discussion of contact wheels, lubricants, abrasives and operating techniques. (L10, NM-h, NM-j)

82-L. The Role of Modern Barrel Finishing. C. J. Glasrud. *Plating,* v. 44, Jan. 1957, p. 47-51.

Definition of process, equipment and applications. (L10d)

83-L. Stop Chrome Waste, Pollution and Heat Loss. E. W. Neben. *Plating,* v. 44, Jan. 1957, p. 52-55.

Plating solution recovery system. (L17, A8b)

84-L. Electrodeposited Rhodium in Co-Axial Radio-Frequency Circuits. D. O. Walter. *Platinum Metals Review,* v. 1, No. 1, Jan. 1957, p. 14-19.

Recommendations for thickness of deposit and suggestions on design of the contact elements. (L17, T1; Ag, *Rh*)

85-L. Deburring Is a Precision Process. *Steel,* v. 140, Jan. 21, 1957, p. 82-85.

Deburring by machinery permits almost machining accuracy, improves surface finish, cleans parts with great time saving over hand methods. (L10)

86-L. Aircraft Engineering Plating. C. L. Hibert. *Western Machinery and Steel World,* v. 48, Jan. 1957, p. 79-83.

Properties and applications of zinc, cadmium, chromium, tin, silver or nickel plating. Data for corrections needed in pre-plate dimensions. (L17; *Zn, Cd, Cr, Sn, Ag, Ni*)

87-L. Degreasing, Surface Treatment and Corrosion Protection. *Wire,* Dec. 1956, p. 33-36.

Machines for rinsing and degreasing, electrostatic lacquering, phosphating and blueing, galvanizing and pickling. (L general, 1-2)

88-L. (German.) **Investigations on the Pickling Process.** Werner Lueg, Winfrid Dahl and Hans-Juergen Engell. *Stahl und Eisen,* v. 76, Dec. 13, 1956, p. 1678-1685.

Materials tested and testing methods, pickling tests on hot rolled strip in sulphuric acid, on samples with scale formed during annealing in sulphuric acid and hot-rolled strip in hydrochloric acid, in a mixed acid solution, subsequent treatment by prestressing, and conclusions. 5 ref. (L12g; ST)

89-L. (German.) **The Diamond as a New Polishing Material.** Rudolf Vogel. *Zeitschrift für Metallkunde,* v. 47, Dec. 1956, p. 775-777.

Application of diamond powder. The method, useful for soft as well as hard alloys, reduces the time required for polishing and avoids difficulties arising in some cases with alumina. (L10b; NM-k 37)

90-L. Surface Finishing. *Aircraft Production,* v. 19, Jan. 1957, p. 2-7.

Barrelling method for surface finishing high-tensile steel; spar finishing machine and its operations. (L10d; ST, SGB-a)

91-L. Cyclic Electrolysis. Part I—The Influence of Periodic Reversal of Current Upon Concentration Polarization During Metal Deposition. A. Hickling and H. P. Rothbaum. *Bulletin of the Institute of Metal Finishing,* v. 6, no. 4, winter 1956-1957, p. 53-66.

In the cathodic part of the cycle the onset of limiting diffusion conditions is deferred, and the current efficiency and average rate of metal deposition are increased. Effects are greatest under conditions such that diffusion away from the electrode of anodically formed ions is minimized. 5 ref. (L17)

92-L. The Mechanism of Deposition of Titanium Coatings From Fused Salt Baths. M. E. Straumanis, S. T. Shih and A. W. Schlechten. *Electrochemical Society; Journal,* v. 104, Jan. 1957, p. 17-20. (CMA)

Titanizing consists of the collision of titanium particles, dispersed in a molten bath, with a ceramic or metallic surface, and diffusion into a substrate if the temperature is sufficient. Coats may be applied to iron, using KCL or NaCl baths and larger amounts of dispersed titanium subchlorides. Lower titanium chlorides are produced through the reduction of bath chlorides by titanium. Working temperatures vary, but are above 900° C. 14 ref. (L15; Fe, *Ti*)

93-L. A New Method for the Determination of Sulphate in Chromium Plating Solutions. C. J. Keattch. *Electroplating and Metal Finishing,* v. 10, Jan. 1957, p. 2-6.

Efficient analytical procedure involves reduction of sulphate to sulphide followed with volumetric determination. 11 ref. (L17a, S11j; *Cr*)

94-L. Shot Blasting and Shot Peening of Light Alloys. F. Flusin. *Electroplating and Metal Finishing,* v. 10, Jan. 1957, p. 15-17.

Applications, advantages and limitations of siliceous sand, corundum sand, iron shot, vegetable particles, light alloy shot and vapor blasting. (L10c, G23n; EG-a 39, NM-j)

95-L. Whirlpool's New Dryer Finishing System. Henry Karvalski. *Finish,* v. 14, Jan. 1957, p. 38-41.

Flow-coating and draining off the primer; electrostatic spraying of enamel. (L26n)

96-L. How We Finish Instrument Control Panels. Slator S. Taylor. *Industrial Finishing,* v. 33, Jan. 1957, p. 20-24.

Methods of grinding down welds, shot blasting the surfaces, cleaning, application of surfacer and wet sanding of instrument and control panels preparatory to finishing with top-coat pigmented lacquer. (L10c, L12, G18)

97-L. That Protective Coating on the Interior of Beverage Cans. J. A. Chew. *Industrial Finishing,* v. 33, Jan. 1957, p. 32-40.

Automatic operations of blank coating, slitting, forming, soldering, spraying of lacquer and baking of beverage cans. Methods of insuring uniform heat and constant viscosity of the lacquer by the use of paint heaters and compressed air-driven, propeller-type agitators. (L26n)

98-L. Hammer Finishes. *Industrial Finishing,* v. 33, Jan. 1957, p. 43-48.

Production of smooth and durable one-coat hammer finishes. Enumerates the baking formulation, the spraying techniques and the variables influencing the size of the hammer pattern. (L26n, L10g)

99-L. Hard Coatings and Surfaces for Metals. Robert J. Fabian. *Materials & Methods,* v. 45, Jan. 1957, p. 121-140.

Survey of the major types of hard coatings and surfaces, covering metals which can be treated, hardness and thickness, wear and corrosion properties and chief advantages and limitations. 29 ref. (L general)

100-L. Corrosion Resistance; Do You Have It? *Industrial Finishing,* v. 33, Jan. 1957, p. 55-57.

Factors involved in the selection of protective coatings to prevent steel from rusting and corroding, from the view point of the nature of the surfaces to be coated, conditions of exposure and cost. (L general, R general)

101-L. Surface Treatment and Finishing of Light Metals. Part XIII-C. Plating on Aluminum—Zinc Immersion Processes. S. Wernick and R. Pinner. *Metal Finishing,* v. 55, Feb. 1957, p. 61-65.

Effect of solution composition, alloy composition, temperature, pretreatment and double zinc immersion technique. (L16; Al, *Zn*)

102-L. Science for Electroplaters. 21. Throwing Power. L. Serota. *Metal Finishing,* v. 55, Feb. 1957, p. 68-72.

Throwing power determination, current distribution and the cell design. (L17b)

103-L. Bright Nickel Plating. I. R. Bellobono. *Metal Finishing Journal,* v. 3, Jan. 1957, p. 5-9, 12.

The reaction mechanism and theory of preferred orientation of nickel crystals. (L17, M26c; *Ni*)

104-L. A Review of Processes in Current Use for the Surface Treatment of Titanium. H. Richaud. *Metal Finishing Journal,* v. 3, Jan. 1957, p. 10-12. (CMA)

Among the surface treatments of titanium which are reviewed are three pickling processes (Virgo, HF-HCl and HF-HNO_3), anodizing in a sulphuric or phosphoric medium, and electrodeposition on either an electrodeposited zinc film or on an intermediate anodic oxide film. Procedures and materials are described. (L12g, L19n, L17; Ti)

105-L. The Pretreatment of Metal Surfaces. Maxwell Lewis. *Metal Finishing Journal,* v. 3, Jan. 1957, p. 29-36.

Cleaning procedure, phosphating processes, parkerizing, bonderizing and anodizing and other treatments. (L12, L14, L19)

106-L. Alkaline Copper Plating. M. Mercadov. *Metal Industry,* v. 90, Jan. 1957, p. 27-28.

Effects of varying the chemical and physical characteristics of the bath. (L17a, L17b; Cu)

107-L. This Is Barrel-Finishing. *Precision Metal Molding,* v. 15, Feb. 1957, p. 52-57.

Describes the barrel-finishing process permitting the removal of burrs, sharp edges, tool marks, flash and heat treatment scale from small or large quantities of parts. Typical cost savings for barrel finishing as compared with hand finishing are cited. (L10d)

108-L. Porosity Detection in Plated Coatings. *Precision Metal Molding,* v. 15, Feb. 1957, p. 51, 59.

Method of detection of pores and other flaws in electroplated coatings by the photographing of an electroplated specimen exposed to radiation. Reveals pits, voids and inclusions to the order of 0.001 in. in diameter. (L17c, 9-18)

109-L. A New Pre-Paint Treatment for Aluminum. *Precision Metal Molding,* v. 15, Feb. 1957, p. 60-61, 64.

Details of a new surface treatment of aluminum castings, forgings, extrusions or any other fabricated form of aluminum base alloys prior to organic coatings. Indicates that this electrolytic process, using a chromic-phosphoric acid bath of controlled composition and pH, is inexpensive and gives complete adhesion under severe conditions. (L13n; Al)

110-L. Finishing Methods for Magnesium Alloy Pressure Die-Castings.

A. C. Street. *Product Finishing,* v. 10, Jan. 1957, p. 50-58.

Applications of pressure die castings. Degreasing and cleaning methods, chromate treatments, fluoride anodizing baths, pink finishes and protection during storage and transit.
(L12, L14c, L19q; Mg, 5-11)

111-L. Aluminum Dip Coated on Steel Parts. R. F. Joy. *Steel,* v. 140, Feb. 4, 1957, p. 105-106.

Process for applying coat includes precleaning, pickling, preheating, coating and spinning. (L16; ST, *Al*)

112-L. Chemical Base Coatings for Zirconium and Zircaloy. E. J. Hennessey and A. W. Grella. *U.S. Atomic Energy Commission, BRB-28,* March 15, 1956, 26 p. (CMA)

A successful bath has been developed for coating zirconium and Zircaloy prior to deep drawing; the immersion time is 10-12 min., temperature 60°-80° C., and composition is 50 g. per 1. Na_3PO_4, 20 g. per 1. $KF.2H_2O$ and HF to pH 5.0-5.5. A prior aqueous pickle is necessary. The coat is adherent and acts as a lubricant undercoat. Data on the working life of the bath were prepared. Analytical controls are lacking. (L14b, G4; Zr, NM-h)

113-L. Chemical Surface Treatment for Titanium. H. A. Pray, P. D. Miller and R. A. Jefferys. *U.S. Watertown Arsenal Laboratory, Report 401/45-26,* May 1953, 43 p. (PB 111805). Abstracted in *U.S. Government Research Reports,* v. 27, Feb. 15, 1957, p. 57-58. (CMA)

Two immersion treatments are noted which offer practical coats for titanium. The coats when subjected to mild heat treatments will show improved resistance to galling and wear. Core properties are unchanged. (L16; Ti)

114-L. Metallizing Solves Heat and Rust Problems. *Welding Engineer,* v. 42, Jan. 1957, p. 77.

Sprayed zinc or aluminum solved corrosion and heat transfer problems in refrigerator units.
(L23; *Zn, Al*)

115-L. Aircraft Engineering Plating. C. L. Hibert. *Western Machinery and Steel World,* v. 48, Jan. 1957, p. 79-83.

Properties and application of various platings. (L17, T24, 8-12)

116-L. (French.) **Protective Coatings Against Rust and Their Selection in Practice.** *Metallurgie et la Construction Mecanique,* Dec. 1956, p. 1027-1033.

Survey of the causes and nature of corrosive action together with an analysis of factors to be considered in rendering optimum protection. Examples of various methods in specific situations.
(L general, R general)

117-L. (Italian.) **Nickel Plating by Chemical Reduction.** Celestino Stoffel. *Il Nickel.,* no. 64, Oct. 1956, p. 1-11.

Historical data; chemical and physical characteristics of deposits, particularly as obtained by Kanigen process; equipment used for single cycle and continuous cycle baths; applications; cost factors as compared with electrodeposition. 12 ref.
(L28; *Ni*)

118-L. (Book.) **Finishing Handbook and Directory, 1957.** I. S. Hallows, ed. 485 p. 1957. Sawell Publications, Ltd., 4 Ludgate Circus, London E.C. 4, England.

Technical data on cleaning, painting, enameling, and electroplating; directory of manufacturers, list of trade names. (L general)

119-L. (Book.) **Industrial Finishing Year Book 1956.** 244 p. Arrow Press Ltd., 29 Grove Rd., Leighton Buzzard, Beds., England.

Compendium of information covering all aspects of industrial finishing, such as protection, cleaning, polishing, electroplating, paint data, paint finishes, metal coloring. Provides comprehensive tables listing cleaning solutions, physical characteristics of electrodeposited coats, properties of common solvents, electric potentials of metals, barrelling data, etc. Contains also a list of British standards affecting the finishing industry as well as finishing materials and equipment classified both by product and supplier.
(L general, S22)

Metallography

Constitution and Primary Structures

55-M. The Equilibrium Diagram of the System Copper-Germanium. J. Reynolds and W. Hume-Rothery. *Institute of Metals, Journal,* v. 85, Dec. 1956, p. 119-127.

The equilibrium diagram in the region 22 to 100 at. % germanium. The equilibrium diagrams of copper-germanium and copper-silicon are compared. 16 ref. (M24b; Cu, Ge)

56-M. Pseudo-Subgrain Structures on Aluminium Surfaces. N. C. Welsh. *Institute of Metals, Journal,* v. 85, Dec. 1956, p. 129-135.

High-purity annealed aluminum was electrolyzed under conditions ranging from electropolishing to heavy anodic oxidation. Electron-microscope study. (M27c; Al)

57-M. Identification of Inclusions. F. B. Pickering. *Iron and Steel,* v. 30, Jan. 1957, p. 3-9.

Iron-oxygen melts were deoxidized with varied amounts of manganese, aluminum, silicon and titanium. Appearance under normal and polarized light and reaction to various etching reagents was observed. 15 ref.
(M27, D11h; ST, 9-19)

58-M. Dislocation Etch Pits in Silicon Crystals. F. L. Vogel, Jr., and Clarence Lovell. *Journal of Applied Physics,* v. 27, Dec. 1956, p. 1413-1415.

Method for etching dislocations in silicon crystals; dislocations in various alloys observed: low angle boundaries, slip lines, polygonization and bent crystal distribution.
(M26b, M20g; Si)

59-M. Solubility of Boron in Fe_3C and Variation of Saturation Magnetization, Curie Temperature and Lattice Parameter of Fe_3 (C, B) With Composition. M. E. Nicholson. *Journal of Metals,* v. 9, Jan. 1957, p. 1-6.

Based on magnetic data, it is proposed that an electron transfer occurs between the interstitial atoms and the 3d shell of iron. 17 ref.
(M25, P16, Fe, 14-18)

60-M. Aluminum-Magnesium Equilibrium Diagram. J. B. Clark and N. Rhines. *Journal of Metals,* v. 9, Jan. 1957, p. 6-7.

Annealed diffusion couple of pure aluminum and magnesium used to study diffusion layer formation. 6 ref. (M24b, N1; Al, Mg)

61-M. Uranium-Silicon Alloys. A. Kaufmann, B. Cullity and G. Bitsianes. *Journal of Metals,* v. 9, Jan. 1957, p. 23-27.

Description of work done in 1944 on uranium-silicon phase diagram and discussion of properties of an intermediate phase, called ε, whose formula is approximately U_3Si. 6 ref. (M24b; U, Si)

62-M. Structure of the Transition Phase Omega in Ti-Cr Alloys. A. E. Austin and J. R. Doig. *Journal of Metals,* v. 9, Jan. 1957, p. 27-30. (CMA)

In order to better understand the mechanism of diffusion-controlled ω-formation, the structure and orientation relations with the parent β-phase were studied by aging treatments and X-ray diffraction of Ti-Cr alloys. Age hardening in these alloys proceeds through the stages ω precipitation with (100) directions parallel to the original β phase, concurrent alloy enrichment of residual β causing directional strains, and further hardening caused by the strains. 9 ref. (N7a; Ti, *Cr*)

63-M. Twinning in Indium Antimonide. Peter Haasen. *Journal of Metals,* v. 9, Jan. 1957, p. 30-32.

Study of twin boundary planes in InSb and discussion of other types of interfaces which can bound a twin. 8 ref. (M27f; In, *Sb*)

64-M. Investigation of the Effects of Solutes on the Grain Boundary Stress Relaxation Phenomenon. S. Weinig and E. S. Machlin. *Journal of Metals,* v. 9, Jan. 1957, p. 32-41.

Investigation was carried out on copper binary alloys with nickel, silicon, aluminum and silver comprising the range 0.03 to 1 at. % solute. Two stress relaxation peaks of grain boundary origin were ascertained and studied. 12 ref.
(M27f; Cu, *Ni, Si, Al, Ag*)

65-M. X-Ray Satellite Line Structure of Ferrite for CrK Radiation. V. Weiss and E. P. Klier. *Journal of Metals,* v. 9, Jan. 1957, p. 41-43.

Study of diffraction lines resulting from satellite emission spectral lines. 3 ref. (M22g, M26q; Fe)

66-M. Solid Solubility of Carbon in Chromium. W. H. Smith. *Journal of Metals,* v. 9, Jan. 1957, p. 47-49.

Microscopic examination of the as-quenched alloys for the presence of a second phase was used as a measure of the solubility limit. Chromium-carbon phase diagram. 5 ref.
(M24b, N12p; Cr, C)

67-M. Effects of Aluminum on the Cold-Rolled Textures of Titanium. C. J. Sparks, Jr., C. J. McHargus and J. P. Hammond. *Journal of Metals,* v. 9, Jan. 1957, p. 49. (CMA)

Titanium containing 3.8% Al develops a (0001) (1010) texture instead of that usual in pure titanium. The change from the tilted to the nontilted (0001) position is gradual, with added aluminum decreasing the degree of tilt. Adding 0.27% Al decreased the transverse spread of the basal poles. Pole figures are shown. (M26c; Ti, *Al*)

68-M. Unusual Twinning in Annealed Copper. R. L. Segall. *Journal of Metals,* v. 9, Jan. 1957, p. 50.

An unusual thermal etch figure in copper is described and an explanation in terms of twinning suggested. (M27e; Cu)

69-M. Uranium-Zinc System. P. Chiotti, H. H. Klepfer and K. J. Gill. *Journal of Metals,* v. 9, Jan. 1957, p. 51-57.

Phase fields existing in the uranium-zinc system at 1 and at 5 atm. pressure were determined from X-ray, metallographic, thermal and vapor pressure data. The solid solubility of zinc in uranium is very

low and was beyond detection by experimental methods used. 13 ref. (M24b; U, Zn)

70-M. Sigma-Phase in Certain Ternary Systems With Vanadium. J. B. Darby, Jr., and P. A. Beck. *Journal of Metals,* v. 9, Jan. 1957, p. 69-72. (CMA)

Sigma-phase boundaries were studied by microscopy and X-ray in the ternary systems of vanadium with iron and nickel, cobalt or manganese, with nickel and manganese or cobalt, and with cobalt and manganese. The sigma-phase always appears as a long narrow field, connecting the binary sigma phases. The field is narrower in the V-Mn-Ni system than in the V-Mn and V-Ni systems. This is true of the V-Ni-Co system, in which the concavity of the phase boundary toward low vanadium contents stems from coexistence with a second, stable phase. Isothermal sections at 1000° and 1200° C. are shown. (M24c; V)

71-M. Constitution of Nickel-Rich Quinary Alloys in the System Ni-Fe-Cr-Ti-Al. A. Taylor. *Journal of Metals,* v. 9, Jan. 1957, p. 72-75. (CMA)

In a study of the Ni-Fe-Cr-Ti-Al system attention was given the 750 and 1000° C. isothermals of the section Ni_3Cr-Ni_3Ti-Ni_3Fe-Ni_3Al. The phases involved are the f.c.c. primary γ solid solution, the f.c.c. Berthollide γ-phase based on Ni_3Al, and the h.c.p. Daltonide, η-Ni_3Ti. The η and γ fields remain unchanged with increases in temperature but the γ field increases. Ternary diagrams are shown. 3 ref. (M24d; Ni, *Fe, Cr, Ti, Al*)

72-M. Preliminary Investigation of the Ti-Ce System. J. L. Taylor. *Journal of Metals,* v. 9, Jan. 1957, p. 94-96. (CMA)

A study of the Ti-Ce system included X-ray diffraction, microscopy, incipient melting and construction of cooling curves. The peritectoid-type phase diagram includes no intermetallic compounds up to 50 wt. % Ce and a liquid miscibility gap is indicated. Cerium solubility is less than 1% near the peritectoid temperature and decreases to 0.19% at 750° C. An anomaly in the cooling curve with 9.2% Ce showed a latent heat effect between 1300-1350° C. 5 ref. (M24b; Ti, *Ce*)

73-M. Metallography of Aluminum Powder Extrusions. F. V. Lenel, G. S. Ansell, and E. C. Nelson. *Journal of Metals,* v. 9, Jan. 1957, p. 117-124.

Metallographic investigation of experimental and commercial sintered aluminum-powder extrusions using a high-resolution replication technique for electron microscopy. 6 ref. (M27, M21e; Al, 6-22)

74-M. Uranium-Bismuth System. R. J. Teitel. *Journal of Metals,* v. 9, Jan. 1957, p. 131-136.

Crystallographic data reported for three intermetallic compounds: UBi_2, which decomposes peritectically at 1010° C; U_3Bi_4, which decomposes peritectically at approximately 1150° C; and UBi, which decomposes to two liquid phases at a temperature between 1400 and 1450° C. Little solid solubility for either component in the other was indicated. More study needed on high-temperature reaction. 11 ref. (M24b; U, Bi)

75-M. Phase Diagram and Vapor Pressure in the Systems $NaCl$-$ZrCl_4$, KCl-$ZrCl_4$, and NaCl-KCl(1:1 Molar)-$ZrCl_4$. L. J. Howell, R. C. Sommer and H. H. Kellogg. *Journal of Metals,* v. 9, Jan. 1957, p. 193-200. (CMA)

Portions of the diagrams of KCl and/or NaCl with $ZrCl_4$ were determined. The studies indicated two types of melt that are promising electrolytes for zirconium electrodeposition: melts near the $ZrCl_4$-rich eutectic, and those in the region of the NaCl-rich eutectic. The former has the lowest melting point in the systems studied. Another paper (to be published) is cited which reports that the electrical conductivity is adequate for electrolysis. The high concentration of $ZrCl_4$ permits the rapid transfer of zirconium ions to the cathode by diffusion. (M24d, P12c, C13n; Zr)

76-M. The Study of Fracture Surface Markings. C. F. Tipper. *Journal of the Iron and Steel Institute,* v. 185, Jan. 1957, p. 4-9.

Investigation of a fractured plate from an oil-storage tank to relate macrostructure with microstructure. 8ref. (M27, M28; ST, 9-22)

77-M. The Formation of Carbides in Low-Carbon, Chromium-Vanadium Steels at 700° C. S. W. K. Shaw and A. G. Quarrell. *Journal of the Iron and Steel Institute,* v. 185, Jan. 1957, p. 10-22.

Carbides were extracted from steels containing 0.2% C, with up to 12% Cr and 2% V and examined by X-ray and chemical analyses to establish the constitution of the carbide phase at 700° C. and to study the approach to equilibrium. 8 ref. (M26r; AY, SS, *Cr, V*)

78-M. (German.) **The Occurrence of a Cubic Nitride in Aluminum Alloyed Steels.** Walter Koch, Christal Ilschner-Gensch and Helga Rohde. *Archiv für das Eisenhüttenwesen,* v. 27, Nov. 1956, p. 701-706.

Nitrided low-carbon steels were analyzed microscopically and the nitrogen distribution was determined micro-analytically for different layers. Precipitates were isolated electrolytically and analyzed by X-ray, micro-analysis, microscope and electron microscope. The cubic nitride was identified by selected area diffraction. 8 ref. (M21, M22; AY, *Al,* 14-18)

79-M. (German.) **Inclusion Experiments on Synthetic Mullite. Part I.** Günther Gelsdorff and Hans-Ernst Schwiete. *Archiv für das Eisenhüttenwesen,* v. 27, Dec. 1956, p. 807-811.

Synthetic mullite was made from purest alkali-free materials and the X-ray indices were determined. By means of X-ray it was found that up to 6% Al_2O_3, 3% Fe_2O_3 and 1.5% TiO_2 can be included into the mullite lattice. Only iron oxide and titanium oxide cause a lattice expansion. 17 ref. (M26r; RM-h)

80-M. (German.) **Gold Under the Electron Microscope.** E. Brueche and H. Poppa. *Metall,* v. 11, Jan. 1957, p. 18-21.

Electron microscope photographs of gold surfaces with explanations of the markings. 4 ref. (M27, M21e; Au)

81-M. (German.) **Texture and Ear Formation of Pure Aluminum Sheets From Continuously and Discontinuously Cast Ingots.** F. Haessner, G. Masing and H. P. Stuewe. *Zeitschrift fur Metallkunde,* v. 47, Dec. 1956, p. 743-750.

The texture of aluminum sheet rolled from continuously and discontinuously cast ingots of different pretreatment was determined and their relations to position and height of earing investigated. The different recrystallization behavior was found to be caused by different content of precipitate. Results are discussed and compared with other publications. 26 ref. (M26c; Al, 4-3)

82-M. (German.) **The System Copper-Silver-Cadmium II.** Erich Gebhardt and Guenter Petzow. *Zeitschrift für Metallkunde,* v. 47, Dec. 1956, p. 759.

In continuation of previous work, especially melting-equilibria and four-phase-reactions are investigated in the ternary system copper-silver-cadmium. Temperature-concentration-sections with constant silver- and copper-concentration of 5% for each as well as isothermal sections at 600, 500 and 300° mediate a picture of the shape of the phase-spaces. Altogether ten four-phase-reactions are stated. (M24c; Cu, Ci, Cd)

83-M. The Crystal Structure of the P Phase, Mo-Ni-Cr. II. Refinement of Parameters and Discussion of Atomic Coordination. D. P. Shoemaker, C. B. Shoemaker and F. C. Wilson. *Acta Crystallographica,* v. 10, Jan. 10, 1957, p. 1-14. (CMA)

Lattice constants and positional parameters were refined for the crystal structure of the P phase, Mo-Ni-Cr. The lattice constants of the orthorhombic crystal are a = 9.07Å, b = 16.983Å and c = 4.752Å. The unit cell contains 56 atoms. (M26p; Mo, Ni, Cr)

84-M. The Influence of Tellurium and Lead on the Occurrence of Some Abnormal Formations of Graphite in Gray Cast Irons, and Their Effect on the Mechanical Properties. G. E. Morton. *British Cast Iron Research Association, Journal of Research and Development,* v. 6, Dec. 1956, p. 436-443.

An examination of five commercially produced castings which failed before or during service. The abnormal forms of graphite studied in this paper are: (1) mesh, (2) "spiky" and (3) "Widmanstatten". 4 ref. (M27; CI-n)

85-M. The Use of Diamond Abrasives in Metallographic Polishing. L. E. Samuels. *Industrial Diamond Review,* v. 16, Dec. 1956, p. 233-236.

Advantages of diamond abrasives include high rate of polishing, good quality polishing, and retention of nonmetallic inclusions. (M20p; NM-k 37)

86-M. The Cold-Rolled Texture of Hafnium. D. S. Eppelsheimer and D. S. Gould. *Institute of Metals, Journal,* v. 85, Dec. 1956, p. 158-160. (CMA)

Arc-melted 3% Zr hafnium alloy was reduced 95% in gage by cold rolling. The preferred orientation of the strip was studied by X-ray diffraction. The texture is similar to other hcp metals and can be said to be (0001) (1010) rotated 25° about the rolling direction. Pole figures are shown. 11 ref. (M26c; Hf, *Zr*)

87-M. X-Ray Study of the Change in Cu_3Au Near 600° C. B. Borie and B. E. Warren. *Journal of Applied Physics,* v. 27, Dec. 1956, p. 1562-1563.

Physical properties and X-ray measurements of the lattice parameters of quenched specimens. (M26; Cu, *Au*)

88-M. Crystal Structure of Barium and Europium at 293, 78, and 5° K. *Journal of Chemical Physics,* v. 25, Dec. 1956, p. 1123-1124.

X-ray diffraction study. (M27n, M22g; Ba, Eu)

89-M. General Electric's Research Metallographic Laboratory. J. B. Newkirk and A. S. Holik. *Metal Progress,* v. 71, Feb. 1957. p. 78-81.

A group of eight microscopists and four diffraction experts, occupying an efficient layout of 3000 sq. ft., serve the 450 research workers in the General Electric Research Laboratory, examining and reporting on about 520 specimens monthly.
(M20, M21, M22, M23, 1-2)

90-M. Development of Metallurgical Microscopy. J. C. Wright. *Metal Treatment and Drop Forging,* v. 24, Jan. 1957, p. 15-20.

Development of normal light microscopes and of special instruments such as phase contact, polarized light, X-ray, and electron microscopes. Closely linked techniques of metallographic polishing, etching, and photographing considered. 40 ref. (M21, M20)

91-M. Phase-Diagram Study of Alloys in the Iron-Chromium-Molybdenum-Nickel System. C. J. Bechtoldt and H. C. Vacher. *National Bureau of Standards, Journal of Research,* v. 58, Jan. 1957, p. 7-19. (CMA)

Alloys of 70-80% iron, with chromium, molybdenum and nickel contents varying from 0, 30 and 20%, respectively, were studied. Five hard, intermetallic, stable, coexisting phases have been identified, and all contain molybdenum. Quenching treatments are described. Isothermal sections, photomicrographs and X-ray data. 29 ref.
(M24d; Fe, *Cr, Mo, Ni*)

92-M. The Metallographic View. XXX. Nitriding the Higher Alloy Steels. Howard E. Boyer. *Steel Processing,* v. 43, Jan. 1957, p. 36-37, 45.

Metallographic and hardness study of nitrided Type 410 stainless and hot work toolsteel.
(M27, Q29n, J28k; SS, TS-k)

93-M. (English.) **Electron Diffraction Study on Thin Alloy Films of Aluminum-Silver System.** Denjiro Watanabe. *Physical Society of Japan, Journal,* v. 11, Oct. 1956, p. 1072-1078.

Electron diffraction study of the evaporated alloy consisting mainly of hexagonal close-packed phase and cubic beta-phase.
(M26p; Al, Ag, 14-12)

94-M. Constitution Diagram of the Antimony-Zirconium Alloy System. R. F. Russi, Jr., and H. A. Wilhelm. *U.S. Atomic Energy Commission, ISC-204,* Aug. 1951, 46 p. (CMA)

Sb-Zr alloys made from a master alloy of 23.6% Sb were used to study phase equilibria in the Sb-Zr system. Adding antimony to zirconium raises the α-β transformation and promotes a peritectoid transformation. β-Zr solid solution extends to 14% Sb and 1430° C. Antimony is 2.5% soluble in α-Zr. Higher percentages of antimony increasingly harden and embrittle zirconium. The additions also increased corrosion resistance in 315° C. water.
(M24b; Sb, Zr)

95-M. Crystal Structures of Transition Metal Silicides. C. H. Dauben. *U.S. Atomic Energy Commission, UCRL-3602,* Oct. 1956, 8 p. (CMA)

Structural data are given for the following transition metal silicides: $TiSi_2$, $ZrSi_2$, $CrSi_2$, VSi_2, $CbSi_2$, $TaSi_2$, $MoSi_2$, WSi_2, ZrSi, CrSi, Zr_3Si_2, Ti_5Si_3, Zr_5Si_3, V_5Si_3, Cb_5Si_3, Ta_5Si_3, Cr_5Si_3, Mo_5Si_3, W_5S_3i, Nb_5Si_3, Ta_5Si_3, Zr_2Si, Ta_2Si, V_3Si, Cr_3Si, Mo_3Si and $Ta_{4.5}Si$. Data presented include the ideal structure type of the compounds, space groups and lattice constants. 34 ref.
(M26r; Ti, Zr, Cr, V, Cb, Ta, Mo, W)

96-M. (English.) **A Microscope Study of Etched Germanium Surfaces.** Makoto Kikuchi and Seiichi Denda. *Physical Society of Japan, Journal,* v. 11, Oct. 1956, p. 1127.

Composition of etching solutions and structure of pits.
(M27a, M20q; Ge)

97-M. (German.) **The Origin of the Small Angle Scattering of X-Rays in Plastically Deformed Metals.** S. Seeger. *Acta Metallurgia,* v. 5, Jan. 1957, p. 24.

New small angle scattering concept; the small angle scattering responds to local changes in density in the irradiated sample. 11 ref.
(M22g, Q24)

98-M. (Japanese.) **On the Determination of Austenite Grain Size of Steel by the Oxidation Method.** Yoshiaki Masuko and Tatsuro Onitake. *Sumitomo Metals,* v. 8, Oct. 1956, p. 236-254.

Comparison with other methods for determining austenite grain size for many kinds of carbon steels and low-alloy steels. "Heat etching" method for checking the inhibiting effect of oxidation upon grain growth discussed. 14 ref.
(M27c, 1-4; CN, AY)

99-M. (Russian.) **Methods of Investigating the Structure of Metals and Alloys During High-Temperature Heating Under Vacuum.** M. G. Lozinsky. *Termicheskaya Obrabotka i Svoystva Litoy Stali,* Moscow, 1955, p. 322-356.

Equipment and methodology used. The installation, containing a built-in vertical microscope, was designed and tested at the Institute of Machine Sciene, Academy of Sciences, USSR. A thorough description, complete with photographs and line drawings, of the equipment and its operation is presented.
(M21, 1-2, 1-23, 2-12)

100-M. (Russian.) **Chemical Interaction of Titanium With Other Elements.** I. I. Kornilov and P. B. Budberg. *Uspekhi Khimii,* v. 25, Dec. 1956, p. 1474-1501. (CMA)

Existing literature data on binary systems is surveyed. As a general rule, the character of the interactions between components (formation of solid solutions, formation of chemical compounds with metallic bonds) is determined by the degree of closeness of the components in the periodic system, or, more specifically, by the closeness of atomic radii or of the lattice patterns (metals forming a continuous series of solid solutions are closest; metals forming several compounds are more or less distant). Four types of binary systems are distinguished: 1) Systems showing continuous solid solutions for both modifications of titanium (α and β); zirconium and hafnium are the elements that form such systems with titanium. 2) Systems with continuous solid solutions for β-titanium only; vanadium, columbium and tantalum belong to this group. 3) Systems with limited solid solutions for both modifications of titanium, and with an entectoid transformation; chromium, tungsten, manganese, iron and nickel belong to this type. 4) Systems with limited solid solutions for both modifications of titanium and with a peritectic (or peritectoid) transformation; nitrogen, oxygen, carbon, tin and aluminium belong here. Numerous phase diagrams are given. 90 ref.
(M24b; Ti)

N Transformations and Resulting Structures

66-N. Solution-Rate Studies With Liquid Metals: Solution of Copper in Liquid Lead and Bismuth. A. G. Ward and J. W. Taylor. *Institute of Metals, Journal,* v. 85, Dec. 1956, p. 145-152.

Kinetics of dissolution, experimental method and its results. 16 ref. (N12; Cu, Pb, Bi)

67-N. Creep-Resisting Steels. M. G. Gemmill, H. Hughes, J. D. Murray, F. B. Pickering and K. W. Andrews. *Iron and Steel,* v. 29, Dec. 8, 1956, p. 614-623.

High-temperature steels; structural and theoretical aspects of TiC, TiN, gamma phase, laves phase, kappa carbide; and for effect of rates of cooling and isothermal heating on precipitation behavior; effects of prior structure, mechanical and high-temperature properties.
(N7b, N8, 2-10; SGA-h)

68-N. Magnetic Method for the Measurement of Precipitate Particle Sizes in a Cu-Co Alloy. J. J. Becker. *Journal of Metals,* v. 9, Jan. 1957, p. 59-63.

By means of magnetization curves the precipitation of cobalt in a 2% Co copper alloy was followed, the effective particle radii growing from 12 to 70 Angstroms with increasing aging time. 14 ref. (N7b; Cu, *Co*)

69-N. Control of Strain Aging in Alpha-Iron. Eric R. Morgan and J. C. Shyne. *Journal of Metals,* v. 9, Jan. 1957 p. 65-69.

Strain aging is described in terms of the Cottrell theory. Deduced that practical control of strain aging must come through control of effective amounts of carbon and nitrogen in solution. Existing control methods are reviewed and their deficiencies described. Use of titanium, aluminum, vanadium, and boron for control of nitrogen strain aging is examined. 14 ref.
(N7e; Fe, *Ti, Al, V, B, N*)

70-N. Simple Orientation Relationships for Secondary Recrystallization in Si-Fe. C. G. Dunn and P. K. Koh. *Journal of Metals,* v. 9, Jan. 1957, p. 81-86.

Information on textures after primary recrystallization and after secondary recrystallization from the view point of oriented nucleation growth selective theory. Explanation for large primaries (nuclei) occurring in specific orientations. 12 ref. (N5h; Si, Fe)

71-N. Nucleation of Voids in Metals During Diffusion and Creep. R. Resnick and L. Seigle. *Journal of Metals,* v. 9, Jan. 1957, p. 87-94.

Experimental evidence is presented which proves that voids formed during diffusion in brass are heterogeneously nucleated. When the nuclei, probably ZnO, are removed by remelting, practically no voids form upon subsequent dezincification. Brass, freed of void nucleation catalysts, exhibited reduced tendency for grain boundary cracking during creep, and increased stress-rupture life. 18 ref.
(N1, Q3m; Cu-n)

72-N. Studies on Diffusion in Molten Metals. Kichizo Niwa, Mitsuo Shimoji, Satoshi Kado, Yoshihiko Watanabe and Toshio Yokokawa. *Journal of Metals,* v. 9, Jan. 1957, p. 96-101.

Diffusion coefficients in molten metals were measured for Sn-Pb, Bi-Pb, Sb-Pb, Cd-Pb, Sn-Bi, and Sb-Sn from 450° to 600° C. Results show that the relations between diffusion coefficients and atomic fractions obey the thermodynamic formulas of irreversible processes. 19 ref. (N1e; 14-10)

73-N. Effect of Rolling Procedure on the Kinetics of Recrystallization of Cold-Rolled Copper. J. T. Michalak and W. R. Hibbard, Jr. *Journal of Metals,* v. 9, Jan. 1957, p. 101-106.

OFHC copper was rolled 96.4% by straight-pass, cross-pass, and compression-pass techniques. Materials developed different deformation and recrystallization textures, different 1-hr. recrystallization temperatures, and different recrystallization kinetics, although they had the same temperature dependence of the rate of recrystallization, QR. 11 ref. (N5f, F23, 1-17; Cu)

74-N. On the Kinetics of the Pearlite Reaction. John W. Cahn. *Journal of Metals,* v. 9, Jan. 1957, p. 140-144.

Re-evaluation of existing kinetic data in terms of recently derived rate laws. Nucleation rate varies more rapidly with temperature than previously supposed. Time dependence of the nucleation rate obtained from kinetic date is consistent with that observed by metallographic methods. Analysis of pearlite reaction in presence of carbide particles. 13 ref. (N8h)

75-N. The Repeated Strain Aging of Mild Steel. B. B. Hundy and T. D. Boxall. *Metallurgia,* v. 55, Jan. 1957, p. 27-30.

Results of experiments show that the effects of all aging and cold working of mild steel on the mechanical properties are additive. Explanation is given based on the dislocation theory of strain aging. 6 ref. (N7e; CN)

76-N. The Effect of Titanium Content on the Age Hardening and Nitriding of Type 322 Stainless Steel. M. R. Achter. *U. S. Atomic Energy Commission. WAPD-RM-*91, Sept. 26, 1951, 10 p. (CMA)

Titanium is the chief hardener in Type 322 stainless but concentration control is difficult. Concentration affects the nature of the nitrided case. A hardness curve was constructed from data on specimens with different titanium contents. The steel high in titanium tended to show pitted and spalled cases; 0.70% Ti seems to be the critical content. Other factors were implicated. (N7a, 2-10; SS, *Ti*)

77-N. Graphitization of Steel in Petroleum Refining Equipment. Joseph G. Wilson. *Welding Research Council Bulletin Series,* no. 32, Jan. 1957, p. 1-35.

Graphitization under service conditions; effect of steel specifications; effect of certain elements. 11 ref. (N8s, 1-10; ST)

78-N. The Effect of Graphitization of Steel on Stress-Rupture Properties. Joseph G. Wilson. *Welding Research Council Bulletin Series,* no. 32, Jan. 1957, p. 36-44.

Concentrated forms of graphite at weld heat-affected zones may adversely affect the rupture strength of steel. Random forms of graphite up to "moderate" degrees in the unaffected parent metal do not appear to be detrimental. (N8s, Q3m; ST)

79-N. (German.) **Recrystallization Experiments With Nickel-Chromium and Iron-Nickel-Chromium Alloys.** Hannelore Kofler-Valencak and Helmut Krainer. *Archiv für das Eisenhüttenwesen,* v. 27, Nov. 1956, p. 725-730.

The cold working and recrystallization behavior of the 80-20 and 30-20 Ni-Cr and Fe-Ni-Cr alloys with regard to mechanical properties, grain growth and X-ray data corresponds to the usual behavior of cold worked and heat treated alloys. The decrease or invariability of the electrical resistance during cold working and the deviations of the relaxation curves of the electrical resistance are irregular. 6 ref. (N5, P15g; Ni, *Cr,* SS)

80-N. (German.) **Calorimetric Investigations of the Kinetics of the Tempering of Martensite.** Otto Krisement. *Archiv für das Eisenhüttenwesen,* v. 27, Nov. 1956, p. 731-742.

Four unalloyed steels with 0.21, 0.41, 0.58 and 0.79% C were investigated with regard to the martensite tempering between room temperature and 300° C. The microcalorimetric procedure according to Borelius was applied. Correlations between phase transformations and heat generation are described. 17 ref. (N8p, 1-4; CN)

81-N. Phase Transformations in Iron-Platinum Alloys Near the Composition Fe_3Pt. A. E. Berkowitz, F. J. Donahoe, A. D. Franklin and R. P. Steijn. *Acta Metallurgia,* v. 5, Jan. 1957, p. 1-12.

Resistance measurements on polycrystalline wires were used to study the ordering process. Resistivity, Curie temperature, metallographic and magnetic examination and the results. 6 ref. (N10a, 1-4; Fe, *Pt*)

82-N. Surface Migration on Tantalum Crystals Under Influence of Electric and Thermal Gradients. David B. Langmuir. *Acta Metallurgia,* v. 5, Jan. 1957, p. 13-23.

Stereographic projection and diffusion studies. 15 ref. (N1a; Ta)

83-N. Self-Diffusion and Interdiffusion in Gold-Nickel Alloys. J. E. Reynolds, B. L. Averbach and Morris Cohen. *Acta Metallurgia,* v. 5, Jan. 1957, p. 29-40.

The data are combined with the thermodynamic properties to test the validity of the Darken equation. Equations for the relationship between the activation energies for self and interdiffusion. (N1b, P13a; Au, Ni)

84-N. Atomic Radiation Used to Study Growth of "Whiskers" on Metals. *Bell Laboratories Record,* v. 35, Jan. 1957, p. 29.

X-ray studies of the crystal structures of metal. (N3r, M23q)

85-N. The Structure of Titanium Deposits Formed in Electrolytic Cells Using Fused Alkali Chloride Bath. R. S. Dean, W. W. Gullett and F. X. McCawley. *Chicago Development Association, Contributions to Titanium Metallurgy. Paper no. 2,* 1957, 6 p. (CMA)

Electrolytically formed titanium deposits of practical value are of three coexisting types: a titanium plate on the cathode, a dispersion of fine titanium crystals in the salt bath, and coarse titanium crystals from a supersaturated solution of alkali metal. The dispersion is depleted of titanium because of the formation of the cathode plate. (N12d; Ti)

86-N. Grain Growth in Steels: Role of Aluminium Nitride—Part I. A. B. Chatterjea and B. R. Nijhawan. *Metal Treatment and Drop Forging,* v. 24, Jan. 1957, p. 3-6.

Results of brief survey of information on grain growth in steels and alloys; different views on grain-growth inhibition in steels. 53 ref. (N3m; ST)

87-N. Chemical Diffusion Rates in Alpha and Beta Zirconium-Tin Solutions. R. Resnick and R. Balluffi. *U.S. Atomic Energy Commission, SEP-118,* Aug. 11, 1953, 12 p. (CMA)

The chemical diffusivity of tin-stabilized α-phase in zirconium-rich alloys was studied using sandwich couples and argon atmosphere. Empirical relations were derived which cover β diffusivity in the range 800-850° C. and α diffusivity in the range 1100-1300° C. 5 ref. (N1e; Zr, *Sn*)

88-N. Metallographic Examination of Zircaloy-2 Subjected to Various Annealing Treatments. E. L. Richards. *U.S. Atomic Energy Commission, WAPD-RM-156,* Nov. 26, 1952, 21 p. (CMA)

Zircaloy-2 in the as-forged and rolled condition was heat treated. A suitable heat treatment consists of holding at 850° C. for 15 min. and air cooling; complete recrystallization resulted. The hardness is Rockwell B-85 to 89. The α-β transformation begins in the 900-925° C. range. (N6p, J23c; Zr)

89-N. (French.) **Cinematographic Study of the Growth of Titanium β Crystals by Means of the Emission Electron Microscope.** Mecheline Sorel-Sternberg and Robert Arnal. *Academie des Sciences. Comptes Rendus des Seances,* v. 244, no. 1, Jan. 2, 1957, p. 92-95. (CMA)

Crystal growth in titanium has been studied by means of an emission electron microscope provided with a recording device. The temperature of the sample was raised to 1100° C. for 15 min., cooled below the $\beta \rightarrow \alpha$ transformation point (880° C.), and finally reheated to 1100° C. The observations indicate that the thermal treatment introduces a stress in the β crystals which permits one to obtain these β crystals at a high temperature in a simple manner. (N16p, M21e; Ti)

90-N. (Italian.) **Study of Crystal Orientation in Cold Rolled and Recrystallized Carbon Steel.** H. Weik. *Metallurgia Italiana,* v. 48, Nov. 1956, p. 494-502.

Pretreatment of samples and research procedures; influence of degree and method of rolling, of temperature of recrystallization; method of eliminating crystal orientation resulting from rolling. Geiger counter method of evaluation used. 28 ref. (N5g; CN)

91-N. (Report.) **A Critical Review of the Mechanism of Aging in Alloys Based on the Aluminum-Zinc-Magnesium System.** I. J. Polmear. ACA-59. 22 p. Aug. 1955. Australian Aeronautical Research Committee, Aeronautical Research Laboratories, Box 4331, P.O., Melbourne, Australia.

Effect of age hardening on the changes in structure and properties in alloys of the 75S type. The most significant factor in the development of high strength properties lies in

the pronounced effect of small additions of magnesium on the aging characteristics of the binary aluminum-zinc alloys. Qualitative treatments are suggested to account for this effect, one based on lattice strain energy and the other on thermodynamic relationships.
(N7a; Al, *Zn, Mg*)

92-N. (Book—French.) **Curves of Transformation of Steels of French Manufacture. Volume II.** G. Gelbart and A. Constant. Institut de Recherches de la Siderurgie, St. Germain-en-Laye, France.

Fifty time-temperature-transformation curves (isothermal transformation diagrams) of various types of steel—tool, chromium, manganese, etc. Contains also Jominy curves, tables of chemical composition, photomicrographs. (N8g; ST)

Physical Properties

55-P. Free Energy of Formation of Mn_7C_3 From Vapor Pressure Measurements. C. Law McCabe and R. G. Hudson. *Journal of Metals,* v. 9, Jan. 1957, p. 17-19.

Pressure measurements by the Knudsen cell method to determine the free energy of formation of manganese carbide in the temperature range 800° to 950° C. 7 ref.
(P12a, 1-4; Mn, 14-18)

56-P. Thermodynamics of Slag Systems. Part I—The Thermodynamic Properties of CaO-Al_2O_3 Slags: Part II—The Thermodynamic Properties of CaO-SiO_2 Slags. P. T. Carter and T. G. Macfarlane. *Journal of the Iron and Steel Institute,* v. 185, Jan. 1957, p. 54-66.

Study of the equilibrium between CO-CO_2-SO_2 gas mixtures and CAO-Al_2O_3, and between CO-CO_2-SO_2 and CaO-SiO_2 slags at 1500° C. and determinations of heats and free energies of formation. 49 ref.
(P12q, P12a; RM-q)

57-P. (German.) **Thermodynamic Analysis VIII. Calorimetry and Thermodynamics of Indium-Zinc Alloys.** Willy Oelsen and Peter Zühlke. *Archiv für das Eisenhüttenwesen,* v. 27, Dec. 1956, p. 743-752.

Indium-zinc alloys mix completely in the melt but are nearly immiscible in the solid state. The solidification curves show deviations from the law of freezing point depression for low zinc contents. A thermodynamic analysis of these alloys is carried out. 13 ref.
(P12; In, Zn)

58-P. (German.) **Temperature Dependence of Susceptibility of Iron-Chromium Alloys.** Werner Köster and Albrecht. von Kienlin. *Archiv für das Eisenhüttenwesen,* v. 27, Dec. 1956, p. 787-792.

The dependence of the susceptibility on the field strength at different temperatures is determined for two commercial iron-chromium alloys having 17.9 and 24.7% Cr and one very pure alloy with 26.4% Cr. The resulting permeability-temperature curves are discussed. 18 ref.
(P16q, 2-11; Fe, *Cr*)

59-P. (German.) **Mean Specific Heats of Cemented Carbides Between Room Temperatures and −190° C.** H. J. Boosz. *Metall,* v. 11, Jan. 1957, p. 22-23.

Specific heats were measured by means of an evaporation calorimeter. Molecular heat of tungsten carbide is estimated at 6.85 cal/mol. 9 ref.
(P12r; W, 6-19)

60-P. (Russian.) **Heats of Formation of Titanium Silicides.** Yu. M. Golutvin. *Zhurnal Fizicheskoi Khimii,* v. 30, no. 10, Oct. 1956, p. 2251-2259. (CMA)

Combustion heats of the three known titanium silicides, $TiSi_2$, TiSi and Ti_5Si_3, as well as of titanium and silicon, were measured by burning in a quartz cup placed in a bomb. From the data obtained the following values of standard heats of formation were computed: $TiSi_2$, −42.9 −4.5 kcal/mol; TiSi, −39.2 −3.0 kcal/mol; Ti_5Si_3, −147 −12 kcal/mol. 17 ref.
(P12q, 1-4; Ti, 14-18)

61-P. Interface Energy Studies of Some Copper-Tin Alloys Containing a Liquid Phase. A. A. Krishnan and B. Halder. *Journal of Scientific and Industrial Research,* v. 15B, Dec. 1956, p. 676-681.

The influence of successive additions of tin to copper on the dihedral angle of alpha bronze vs. liquid phases; the effect of temperature on the dihedral angle and on the relative interface energy.
(P13h, 2-11; Cu, *Sn*)

62-P. Heat Capacity of Tungsten Between 4 and 15° K. T. R. Waite, R. S. Graig and W. E. Wallace. *Physical Review,* v. 104, Dec. 1, 1956, p. 1240-1241.

Equation of heat capacity represented with an average deviation of about 1%. The electronic specific heat and Debye temperature evaluated. (P12r; W)

63-P. Conduction Band Structures of Germanium-Silicon Alloys. Maurice Glicksman and Schuyler M. Christian. *Physical Review,* v. 104, Dec. 1, 1956, p. 1278-1279.

Galvanomagnetic measurements in terms of a specific model for conduction band structures.
(P15g; Ge, Si)

64-P. Magnetization Reversal in Thin Film. Donald O. Smith. *Physical Review,* v. 104, Dec. 1, 1956, p. 1280-1281.

Magnetization reversal of 80-20 Permalloy in a strip transmission line. (P16; Ni, SGA-n)

65-P. Slow-Neutron Resonance Scattering in Ag, Au, and Ta. R. E. Wood. *Physical Review,* v. 104, Dec. 1, 1956, p. 1425-1433.

Scattering cross-section analysis by the "bright-line" technique.
(P18m; Ag, Au, Ta)

66-P. The Temperature Dependence of the Electrical Resistivity of the β-Phase Titanium-Molybdenum Alloys. S. Yoshida and Y. Tsuya. *Physical Society of Japan, Journal,* v. 11, Nov. 1956, p. 1206-1207. (CMA)

Five Ti-Mo alloys (12%, 14%, 17%, 25%, and 30% Mo) were studied for electrical resistivity vs. temperature. The anomalous behavior of the curves resembles that of alloys used for electrical resistance use, but temperature hysteresis and aging effects are lacking. The electronic structure is probably the cause of this resemblance. 3 ref.
(P15g, 2-11; Ti, *Mo*)

67-P. Effects of Radiation on Materials. Michael Ference. *Society of Automotive Engineers, Preprint,* Jan. 1957, 10 p.

Attenuation of radiation, basic mechanism of radiation damage and its effects on materials; radiation as a source of energy for chemical reactions, vulcanization of rubber. 14 ref. (A8c; 2-17, 6-12)

68-P. The Theory of Cyclotron Resonance in Metals. M. A. Azbel and E. A. Kaner. *Soviet Physics, JETP,* v. 3, Dec. 1956, p. 772-774.

New form of resonance in metals which differs from diamagnetic resonance; conditions for cyclotron resonance. 6 ref. (P18m)

69-P. Inelastic Scattering Parameters of Zirconium. E. F. Clancy. *U.S. Atomic Energy Commission, KAPL-M-EFC-3,* Nov. 26, 1956, 7 p. (CMA)

Previously outlined procedures used for iron were utilized to determine the inelastic cross section parameters of zirconium. Angular distributions were assumed to be isotropic. (P18j; Zr)

70-P. The Heat Content and Specific Heat of Zirconium-Tin Alloy. R. B. Holden and B. Kopelman. *U.S. Atomic Energy Commission, SEP-128,* 1953, 17 p. (CMA)

The heat content and specific heat of 5% Sn zirconium were determined by drop calorimeter; the respective ranges were 25 to 1500° C. and 100 to 900° C. Accuracies are discussed. (P12r; Zr, *Sn*)

71-P. (English.) **On the Magnetic Properties of the System MnSb-CrSb.** Tokutaro Hirone, Seijiro Maeda, Ichiro Tsubokana and Noburu Tsuya. *Physical Society of Japan, Journal,* v. 11, Oct. 1956, p. 1083-1087.

Change of magnetic properties due to the replacement of manganese in manganese antimonide. 7 ref.
(P16; SGA-n, Mn, Sb, Cr)

72-P. (French.) **The Electrical Conductivity of the Cerium-Hydrogen System.** Joseph Daou and Rodolphe Viallard. *Académie des Sciences, Comptes Rendus des Séances,* v. 243, Dec. 17, 1956, p. 2050-2052. (CMA)

Observations on the cerium-hydrogen system showed that hydrogen is absorbed by cerium at ambient temperatures, causing a measurable increase in the electric resistance. At first the resistance follows the same sigmoid course as the absorption, but as the reaction slows down the resistance decreases, though remaining higher than the original metallic resistance. The decrease in resistance may be due to a contact modification between the microcrystals of the metal hydride or, more likely, may be connected with the evolution of the reticular organization of the system during hydrogenation. 5 ref.
(P15g, N15e; Ce, *H*)

73-P. (German.) **Structure and Magnetic Properties of Permanent Magnet Alloy During Isothermal Segregation Hardening. II.** E. Biedermann and E. Kueller. *Zeitschrift für Metallkunde,* v. 47, Dec. 1956, p. 760-774.

The course of saturation magnetization, residual magnetism, the constant of magnetic viscosity, electrical conductivity and mechanical hardness have been measured as a function of aging time during isothermal hardening of some copper-nickel-iron alloys. Principles for the magnetic behavior of a substance consisting of fine ferromagnetic particles in a nonmagnetic matrix. The course of various magnetic properties during isothermal hardening. 27 ref. (P16, J27d; SGA-n)

74-P. (Russian.) **Some Results of an Investigation of the Isotopic Shift in the Spectrum of Neodymium.** F. A. Korolev and Yu. I. Osipov. *Doklady Akademii Nauk SSSR,* v. 110, 1956, p. 365-367.

The isotopic shift was studied by using a natural neodymium isotope mixture in the region of 4450 to 6500 A. The optical system consisted of a spectrograph ISP-51 with a camera UF-84 and interferometer of GOI (State Optical Institute) construction. The obtained spectrograms were measured by a comparator IZA-2 and some lines photomeasured by a photoelectric recorder MF-4. (P17e, 1-2; Nd, 14-13)

75-P. (Russian.) **The Effect of Admixtures on the Electrical Properties of Lead Telluride.** T. L. Koval'chik and Yu. P. Maslakovets. *Zhurnal Tekhnicheskoy Fiziki,* v. 26, Nov. 1956, p. 2417-2431.

Effect of various admixtures on the type of conductivity exhibited by lead telluride which is considered to be a typical instance of a biocomponent substance. An attempt has been made to define the conditions under which one may expect the appearance of p- and n- conductivity, as has been done in the case of the nonocomponent substances germanium and silicon. (P15g; Pb, Te, 14-18)

76-P. (Russian.) **Concerning Some Possibilities of Measuring the Intensity of Hall EMF Film Transducers Made of HgSe, HgTe, or Their Solid Solutions.** O. D. Yelpat'yevskaya and A. R. Regel'. *Zhurnal Tekhnicheskoy Fiziki,* v. 26, Nov. 1956, p. 2432-2438.

Mercuric selenide and mercuric selenide-mercuric telluride are suitable materials for film transducers to measure the Hall electromotive force which indicates the intensity of the magnetic field. The sensitivity of these transducers approaches that of germanium and indium antimonide. (P15p; Hg, Se, Te)

77-P. (Russian.) **The Diffusion of Lead in Lead Telluride.** B. I. Boltaks and Yu. N. Mokhov. *Zhurnal Tekhnicheskoy Fiziki,* v. 26, Nov. 1956, p. 2448-2450.

Preliminary experiments demonstrated that introduction of lead into lead telluride changes the conductivity of the latter from the hole type to the electron type. The method of electron-hole transitions was used to measure the diffusion of lead into lead telluride. Further research on the diffusion of admixtures into lead telluride is planned with the view of studying the semiconductor properties of lead telluride as affected by these admixtures. (P15g, N1; Pb, Te, 14-18)

78-P. (Russian.) **Concerning the Problem of the Effective Mass of Electrons and Holes in Germanium.** Z. Kopata. *Zhurnal Tekhnicheskoy Fiziki,* v. 26, Nov. 1956, p. 2451-2458.

The authors subject to theoretical investigation the structure of the conductivity zone of germanium by considering the temperature dependence of the thermo-electromotive force and the concentration of current carriers in the region of admixture conductivity. (P15g; Ge)

79-P. (Russian.) **Concerning the Measurement of the Velocity of Surface Recombination in Thin Semiconductor Samples With Qualitatively Different Faces.** O. V. Sorokin. *Zhurnal Tekhnicheskoy Fiziki,* Nov. 1956, p. 2467-2472.

Investigation of the effects of ion and electron bombardment on the velocity of surface recombination in germanium and study of the action of external electric fields and of some chemical substances applied to the surface of germanium samples. (P15; Ge)

80-P. (Russian.) **Concerning the Valve Properties of Silver Selenide and Silver Telluride.** N. G. Klyuchnikov. *Zhurnal Tekhnicheskoy Fiziki,* v. 26, Nov. 1956, p. 2603.

To endow silver selenide and silver telluride plates with valve properties, these plates were firmly compressed between plates of magnesium and copper. A direct current applied on the reversed direction, with the magnesium plate serving as the cathode, was then passed through the silver compound plates. Formation of the barrier layer took place as a result of reduction with magnesium and consequent formation of a thin silver layer. The valves obtained in this manner have interesting potential-current characteristics and a high ratio between the forward and the reverse currents. However, they cannot be used as rectifiers of alternating current, because the initial conditioning disappears when current in the forward direction is passed. The conditioning is also lost on storage. (P15; Ag, Se, Te, 14-18)

Mechanical Properties and Tests

205-Q. Testing Station for Tall Structures. *British Steelmaker,* v. 23, Jan. 1957, p. 16-17.

Design of suitable testing station for load measurements of steel structures. (Q10, T26; ST)

206-Q. Hydrogen Embrittlement of Steel and Its Relation to Weld Metal Cracking. H. G. Vaughan and M. E. de Morton. *British Welding Journal,* v. 4, Jan. 1957, p. 40-61.

Theories of hydrogen embrittlement of steel are discussed and the initiation of cleavage cracks related to the effects of hydrogen on the mechanical properties of steel. 35 ref. (Q26s; ST, 7-1)

207-Q. Flow and Fracture Characteristics of Binary Wrought Magnesium-Lithium Alloys. M. W. Toaz and E. J. Ripling. *Institute of Metals, Journal,* v. 85, Dec. 1956, p. 137-144.

Tensile properties of hexagonal, mixed hexagonal and cubic structures as functions of testing temperature and strain rate. 14 ref. (Q27a, 2-11, 3-17; Mg, *Li*)

208-Q. Effects of Cyclic Stress and Frequency on Deformation Markings in Fatigued Copper. D. S. Kemsley. *Institute of Metals, Journal,* v. 85, Dec. 1956, p. 153-157.

Metallographic examination and results. (Q24c, Q7a, M27; Cu)

209-Q. A New Look at Temper Brittleness. G. K. Bhat. *Iron Age,* v. 179, Jan. 24, 1957, p. 73-77.

Discusses valid method of determination, effects on other mechanical properties, the two modes of embrittlement, sensitivity of tempered martensite, effects of alloying elements on susceptibility to embrittlement and significance of phase at grain boundaries. (Q26s)

210-Q. How to Cut Down on Weld Metal Cracking. *Iron Age,* v. 179, Jan. 24, 1957, p. 83.

Hot cracking promoted by presence of phosphorus, nickel and carbon and reduced by manganese. (Q26, 2-12, 2-10; ST, 1-7)

211-Q. Mechanical Properties of Flake Graphite Cast Irons. G. N. J. Gilbert, A. M. I. Mech. *Iron and Steel,* v. 30, Jan. 1957, p. 19-24.

Review of literature referring to variation of tensile strength with degree of eutectic and relationship between diameter of test bar and tensile strength. To be continued. 19 ref. (Q27a, 1-10; CI)

212-Q. Upper Nose Temper Embrittlement of a Ni-Cr Steel. L. D. Jaffe and D. C. Buffum. *Journal of Metals,* v. 9, Jan. 1957, p. 8-16.

Temper embrittlement of a nickel-chromium steel was investigated both isothermally and with temperature changes. Embrittlement was most rapid in two temperature ranges: 490° to 550° C. and just below the Ae_1, near 675° C. Grain boundary attack and grain growth are discussed. 29 ref. (Q23e, N8a, N3; AY, *Ni, Cr*)

213-Q. On the Nature of Embrittlement Occurring While Tempering a Ni-Cr Alloy Steel. G. Bhat and J. F. Libsch. *Journal of Metals,* v. 9, Jan. 1957, p. 20-22.

A study of the characteristics of the embrittlement in a nickel-below the Ae_1, near 675° F. and at 1250° F. It is suggested that retrogression phenomena are not necessary to explain embrittlement; segregation of solute atoms to prior austenite and ferrite grain boundaries may provide a better explanation. 7 ref. (Q26s, N8a; AY, *Ni, Cr*)

214-Q. Embrittlement of Ti-Al in the 6 to 10 Pct. Al Range. F. A. Crossley and W. F. Carew. *Journal of Metals,* v. 9, Jan. 1957, p. 43-46. (CMA)

A second embrittling phase occurs in titanium with 6-10% Al addition; it is in the form of a precipitate arising at temperatures below 800° C. The degree of embrittlement depends on the aluminum content, aging temperature and time, deformation rate and testing temperature. Data on tensile properties are presented in graphs and tables. 5 ref. (Q26s, Q27a, N7a; Ti, *Al*)

215-Q. Elastic Coefficients of Single Crystals of Alpha Brass. W. R. Hibbard, Jr. *Journal of Metals,* v. 9, Jan. 1957, p. 46.

Re-evaluation and new values for elastic coefficients. 4 ref. (Q21e; Cu-n, 14-11)

216-Q. Creep of Single Crystals and Polycrystals of Aluminum, Lead, and Tin. D. D. Wiseman, O. D. Sherby, and J. E. Dorn. *Journal of Metals,* v. 9, Jan. 1957, p. 57-59.

The activation energies for high-temperature creep of single crystals and polycrystalline specimens of high-purity aluminum, lead and tin were determined by the technique involving the effect of abrupt changes in temperature on the creep rates. 13 ref. (Q3n; 2-11; Al, Pb, Sn)

217-Q. Etch Pit and Slip Bands in Silicon. F. D. Rosi. *Journal of Metals,* v. 9, Jan. 1957, p. 76, 77.

Etch pit technique in the study of deformation markings. 2 ref. (Q24c, 1-4; Si)

218-Q. Grain-Boundary Displacement vs. Grain Deformation as the Rate-Determining Factor in Creep. J. A. Martin, M. Herman and N. Brown. *Journal of Metals,* v. 9, Jan. 1957, p. 78-81.

The height of the vertical grain-boundary displacements was measured on creep specimens of β-brass. The displacements followed a normal distribution whose standard deviation was a function of strain and was independent of temperature from 450° to 501° C. The strength of the grain, not the shear resistance of the boundary, was found to be the rate-controlling factor in the creep of β-brass. 10 ref.
(Q3n; Cu-n)

219-Q. Hydrogen Embrittlement in an Ultra-High-Strength 4340 Steel. E. P. Klier, B. B. Muvdi and G. Sachs. *Journal of Metals,* v. 9, Jan. 1957, p. 106-112.

Embrittlement promoted by copper plating was compared to that developed by cathodic treatment in caustic soda. Tension, notch-tension, bend, and sustained-load tests were employed. Embrittlement was found to depend on strain rates used; however, recovery rate differed for the cleaned and plated specimens. 7 ref. (Q26s, Q27; AY)

220-Q. Tensile Deformation of Silver as a Function of Temperature, Strain Rate, and Grain Size. R. P. Carreker, Jr. *Journal of Metals,* v. 9, Jan. 1957, p. 112-115.

True stress, true strain data are reported for high purity (0.9997+) silver of three grain sizes over the temperature range 20° to 1173° K. Strain rate sensitivity was determined by rate-change tests. 3 ref. (Q24, 2-9, 2-11, 3-17; Ag)

221-Q. Effect of Orientation on the Plastic Deformation of Aluminum Single Crystals and Bicrystals. R. S. Davis, R. L. Fleischer, J. D. Livingston and Bruce Chalmers. *Journal of Metals,* v. 9, Jan. 1957, p. 136-140.

Tensile stress-strain curves reported. Iso-axial bicrystal specimens were used with one crystal rotated 45° about the stress axis with respect to the other. The 45° grain boundary did not raise the stress-strain curve of the bicrystal above that of the corresponding single crystal if two or more slip planes were initially equally favored. 11 ref. (Q24, 3-22; Al, 14-11)

222-Q. Embrittling Effect of Molybdenum on Electrodeposited Copper. H. R. Skewes. *Journal of Metals,* v. 9, Jan. 1957, p. 192. (CMA)

Molybdenum has not been recognized as an element which embrittles copper, and is usually co-precipitated with iron when the leachate from calcined chalcopyrite is treated. In the case of copper obtained from Chuquicamata, Chile, the electrolyte solutions gave brittle electrodeposits when the molybdenum content of the solutions was 10-25 mg per liter. Molybdenum was evidently not co-precipitated with iron, and a reduction to a lower valence state seems likely. (Q26s, N12d; Cu, *Mo*)

223-Q. Investigation of the Behaviour of Metals Under Deformation at High Temperatures. Part III. The Deformation, Microstructure, and Form of Carbides in a 0.15% C, 0.5% Mo Steel in Creep Tests. C. H. M. Jenkins and E. A. Jenkinson. *Journal of the Iron and Steel Institute,* v. 185, Jan. 1957, p. 23-46.

Vacuum tests at 450-850° C. from a few minutes to 13,470 hr. were made to trace extent of transcrystalline and intercrystalline cracking. Relationship of cavities to further deformation and cracking is discussed. Carbides identified by X-ray method. 22 ref. (Q3, M26r; AY)

224-Q. Observations on the Mechanical Behaviour of Heat-Treated Steel at High Hardness Levels. N. H. Polakowski. *Journal of the Iron and Steel Institute,* v. 185, Jan. 1957, p. 67-74.

Hypothesis for the high hardness of martensite and changes taking place in mechanical properties of quench-hardened steel upon temporary or plastic deformation. 45 ref. (Q24, Q29n; ST, 14-19)

225-Q. Influence of Residual Stress on Hardness. P. A. Blain. *Metal Progress,* v. 71, Jan. 1957, p. 99-100.

True hardness is a measure of resistance to impingement rather than the resistance to penetration now determined in "hardness" testing. (Q29, 3-16)

226-Q. The Effect of Surface Finish on Fatigue. B. Cina. *Metallurgia,* v. 55, Jan. 1957, p. 11-19.

Truer values of fatigue strength were obtained from electropolished steel alloys (mainly stainless variety) test pieces than from mechanically polished pieces. Stress-relieving after mechanical polishing gave similar results to electropolishing. 12 ref. (Q7a, L13p; SS)

227-Q. Proposed Program to Provide Design Data for Zirconium for Use in a Zirconium-Graphite-Sodium Reactor System. F. E. Bowman. *U. S. Atomic Energy Commission. NAA-SR-MEMO*-758, Aug. 7, 1953, 13 p. (CMA)

A testing program is proposed for mechanical properties of zirconium to be used in reactors and for zirconium resistance in a sodium milieu. The tests proposed cover tensile and shear strengths and corrosion of zirconium in static and dynamic sodium.
(Q27a, Q2g, R6m, W11; Zr)

228-Q. Creep Rupture of Zirconium Binary Alloys. J. H. Keeler. *U. S. Atomic Energy Commission SO*-2525, Nov. 1956, 24 p. (CMA)

A qualitative similarity exists between the creep and rupture behavior of zirconium and that of its alloys. Alloying increases the stress level necessary for creep and rupture; additions studied included iron, chromium, molybdenum, aluminum, columbium, and tantalum. At 25 and 300° C., low-temperature creep behavior was observed. Creep deformation became significant at 500° C. at low stresses.
(Q3m, Q3n, 2-10; Zr)

229-Q. Zircaloy-2 Hot Bend Tests Performed by the Youngstown Welding and Engineering Co. W. L. Frankhouser. *U. S. Atomic Energy Commission. WAPD-FE*-954, Aug. 10, 1955, 27 p. (CMA)

Zircaloy-2 strips were bent to angular shapes by hot forming; heating was in the 720°-865° F. range but dies were cold, except in one case in which the strips were heated to 620° F. Heating the work entirely by dies is impractical.
(Q6, 2-16; Zr)

230-Q. Tensile Properties of Hafnium-Zircaloy-2 Welds. H. R. Hoge. *U. S. Atomic Energy Commission. WAPD-MDM*-5, April 14, 1954, 13 p. (CMA)

Tensile data from tests of hafnium-Zircaloy-2 welds heated to various temperatures show that the welds are as strong as the component parts at 68° F., and are stronger at higher temperatures. The under-bead porosity does not adversely affect the tensile strength.
(Q27a; Hf, Zr, 7-1)

231-Q. Brittle Fracture Propagation in Wide Steel Plates. W. J. Hall, R. J. Mosborg and V. J. McDonald. *Welding Journal,* v. 36, Jan. 1957, p. 1s-8s.

Plates were tested under various conditions of stress and temperature with a brittle fracture initiated at an edge notch by a wedge subjected to impact. Strain response, crack speed and fracture appearance noted. 3 ref. (Q26q; ST, 4-3)

232-Q. Brittle Fracture Initiation Tests. C. Mylonas, D. C. Drucker and L. Isberg. *Welding Journal,* v. 36, Jan. 1957, p. 9s-17s.

Welded and unwelded notched steel plates with various prestrains were pulled at various temperatures. Transversely prestrained plates with punched notches fractured consistently below yield under static loading. Fractures were as brittle as those found in service in the region of propagation and at point of initiation. 46 ref. (Q26q; ST, 4-3)

233-Q. Behavior of Welded Built-Up Beams Under Repeated Loads. J. E. Stallmeyer, W. H. Munse and B. J. Goodal. *Welding Journal,* v. 36, Jan. 1957, p. 27s-36s.

Small A373 steel beams manually welded using E7016 electrodes and a back-stepping welding procedure, and field splice configurations were fatigue tested in comparison with A373 steel as-received. Presence of splice materially reduces fatigue strength of a welded beam. 6 ref. (Q7a; ST, 7-1)

234-Q. Notch Slow-Bend Testing of Zircaloy-2. R. G. Wheeler. *Welding Journal,* v. 36, Jan. 1957, p. 37s-40s. (CMA)

The effects of notch geometry and the shape of the test piece on the results of slow-bend tests on Zircaloy-2 are evaluated. The testing apparatus is described. Cold work changes the properties of Zircaloy-2 at 25° C., but the change is more noticeable at 350° C. where the fracture angle of the most highly worked material is 400% greater than it is in annealed alloy. The initial change in bend properties with cold work is large. (Q5j; Zr)

235-Q. Properties of Austenitic Chromium-Manganese Stainless-Steel Weld Metal. W. T. DeLong and H. F. Reid, Jr. *Welding Journal,* v. 36, Jan. 1957, p. 41s-48s.

Comparison of chromium-manganese stainless-steel weld metal ties with conventional chromium-nickel weld deposits. The Cr-Mn alloys combine very high strength with reasonable ductility, and high crack resistance in a restrained joint with a completely nonmagnetic structure. 4 ref. (Q27a, Q23p; SS, 7-1)

236-Q. The Significance of the Tensile Test to Pressure Vessel Design. W. E. Cooper. *Welding Journal,* v. 36, Jan. 1957, p. 49s-54s.

Discussion of yield pressure, maximum pressure, strain at maximum pressure and localization of deformation at rupture in terms of initial dimensions of thin-walled cylindrical and spherical shells and the material properties of vessels made of ductile materials. It is not possible to relate the maximum pressure which a vessel can withstand directly to the ultimate tensile strength of the material from which it is constructed. 12 ref. (Q27, 3-24, T26)

237-Q. The Formation and Reduction of Internal Stresses Due to Plastic Deformation. Hans Buhler. *Wire,* Dec. 1956, p. 28-33.

The estimation of internal stresses, effects obtained under conditions of a uniformly stressed and nonuniformly stressed cross-section. 23 ref. (Q25g)

238-Q. (German.) **Investigations of Anelastic Effect in Iron-Chromium Alloys.** Karl Bungardt and Hans Preisendanz. *Archiv für das Eisenhüttenwesen,* v. 27, Nov. 1956, p. 715-724.

Measurements of anelastic effect (grain-boundary damping) of iron-chromium alloys up to 45% Cr. A vacuum apparatus according to Kê was used. Nitrogen and carbon influence the origin of three separate anelastic effect maxima at 220, 600 and 720° C. but there is still no explanation for this influence. 25 ref. (Q22, 1-2; Fe, *Cr*)

239-Q. (German.) **Testing of Unalloyed Steels in a Multiaxial State of Stress by Internal Pressure.** Alfred Krisch. *Archiv für das Eisenhüttenwesen,* v. 27, Dec. 1956, p. 767-775.

Samples of five Thomas and Siemens-Martin steels with 0.04 to 0.2% C were tested for multiaxial stress by a combination of longitudinal stress and internal hydraulic pressure. These samples were drilled hollow, unalloyed, stress unrelaxed and relaxed and partly also age proof. It is shown that yield strength and tensile strength are not altered essentially by the multiaxiality of stress for either the normalized or the artificially aged steels. 13 ref. (Q25g, Q27a; CN)

240-Q. (German.) **Investigation of the 475° Embrittlement of Iron-Chromium Alloys.** Karl Bungardt and Wolfgang Spyra. *Archiv für das Eisenhüttenwesen,* v. 27, Dec. 1956, p. 777-786.

Eight iron-chromium alloys containing from 18 to 45% Cr. were investigated as to changes of hardness, electrical resistivity, dilatation, thermo-electric stress and magnetizability with temperature. The speed of change of the phyiscal properties is largest immediately after the initial heating. After annealing for a longer time the values approach a limit asymptotically. 17 ref. (Q26s, Q29n, P15q, P16, 2-11; SS)

241-Q. (German.) **Considerations Concerning the Change of State Leading to the 475° Embrittlement of Iron-Chromium Alloys.** Werner Köster and Albrecht von Kienlin. *Archiv für das Eisenhüttenwesen,* v. 27, no. 12, Dec. 1956, p. 793-799.

The change of state which leads to the 475° embrittlement of iron-chromium alloys is explained by a segregation into iron-rich and chromium-rich zones. The area of the 475° embrittlement has the form of a two-phase region in the solid state. 28 ref. (Q26s, N12p; Fe, *Cr*)

242-Q. (German.) **The Damping of Mechanical Oscillations During the Martensite Reaction.** Erich Scheil and Johannes Müller. *Archiv für das Eisenhüttenwesen,* v. 27, Dec. 1956, p. 801-805.

The beginning of the γ-α-transformation of the irreversible iron-nickel alloys can be recognized much earlier on the damping curve of mechanical oscillations than on the curves of the elasticity modulus and the electrical resistivity. Formerly this was explained as a "preparation" of the transformation. The work points out that this preparation effect does not exist or is so small that it cannot be measured with the chosen apparatus. 15 ref. (Q7g, N8p; Fe, *Ni*)

243-Q. (Japanese.) **Degree of Fatigue in Metals.** Toshio Nishikara, Toshimori Kore and Ryuiti Masuo. *Nippon Kikai Gakai,* v. 22, Nov. 1956, p. 839-844.

Fatigue is assumed to be caused by crystal distortion; new relation between the repeating stress and the number of stress repetitions observed. (Q7)

244-Q. (Japanese.) **On the Fatigue Strength of Brass and Duralumin.** Yosio Ohasi and Shokei Murayama. *Nippon Kikai Gakai,* v. 22, Nov. 1956, p. 845-850.

The effect of surface rolling on the fatigue strength with grooved specimens made of brass and duralumin. The bottoms of grooves were rolled with varying pressures by a roller which has a thickness half the width of grooves. 4 ref. (Q7a, 3-18, Cu-n, Al)

245-Q. (Japanese.) **An Experiment on Fatigue of Low-Carbon Steel at High Temperature.** Zenji Ando, Yozo Kato and Hicoshiro Watari. *Nippon Kikai Gakai,* v. 22, Nov. 1956, p. 851-855.

Experimental results of the fatigue test under rotating bending stress at high temperatures using unnotched and notched specimens with a circumferential groove on a semicircle of low-carbon steel (0.12% C). The conditions of the fatigue test were: Temperature; advancing by 100° C. from room temperature to 600° C. speed of stress reversals, 1700 rpm. 4 ref. (Q7a, Q7c; CN-g)

246-Q. (Japanese.) **Effect of Mechanical Treatment of Metal Surfaces on Fatigue.** Shigekatsu Karvata. *Nippon Kikai Gakai,* v. 22, Nov. 1956, p. 856-858.

Effect of shot peening a fillet of a stepped shaft on the torsional bending fatigue strength. 25 ref. (Q7a, 3-16)

247-Q. (Japanese.) **The Influence of Surface Roughness on the Mechanism of Contact Between Metal Surfaces.** Genginosuke Yoshimoto, Tadatsu Tsukizoe and Susumu Kikuchi. *Nippon Kikai Gakai,* v. 22, Nov. 1956, p. 859-862.

Theoretical deductions are discussed in the light of experimental evidence; the deduced relationships between the applied load and the distance through which the one surface cuts into the other surface are compared with the results of experiments. (Q9p)

248-Q. (Russian.) **Investigation of the Recrystallization of Titanium and Its Alloys. III. Effect of Annealing Temperature on Mechanical Properties and Microstructure of Titanium.** E. M. Savitski and M. A. Tylkina. *Akademiya Nauk S.S.S.R. Investiya, Otdelenie Tekhnicheskikh Nauk,* no. 10, Oct. 1956, p. 125-127. (CMA)

It is found that, whatever the metallurgical origin of a sample of commercial titanium, its mechanical properties are impaired by the presence of some grams of the β modification, which remain after heating above 1000° C. and subsequent cooling that results in the transformation of the main mass into the α-phase. In order to utilize the favorable plastic properties of a pure α-phase, and to obtain a final product in the same phase, it is recommended to resort to a step-like hot deformation, alternating with annealing and ending in a last step performed after the pure α state has been reached. 1 ref. (Q23, N5, 2-14; Ti)

249-Q. **Internal Friction and Diffusion in 31% Alpha Brass.** J. Hino, C. Tomizuka and C. Werts. *Acta Metallurgia,* v. 5, Jan. 1957, p. 41-49.

Measurements and discussions on the relaxation time of the order peak and the radioactive tracer coefficients of both copper and zinc in single crystals. 21 ref. (Q22, N1c; Cu-n)

250-Q. **Selection of Testing Locations in Aluminum Die Forgings.** Ihor E. Suchoversky. *Aeronautical Engineering Review,* v. 16, Jan. 1957, p. 29-34.

Directionality of mechanical properties, basic method of testing forgings, property level testing. (Q general, 1-4; Al, 4-1)

251-Q. **On the Mechanism of Fatigue.** F. R. Shanley. *Aircraft Engineering,* v. 29, Jan. 1957, p. 11-12.

Discussion on the unbonding of atoms by the repeated application of stresses well below the nominal ultimate tensile strength. (Q7)

252-Q. **Selection of Aluminum Alloys by Fatigue Properties.** R. G. Ward. *Aircraft Engineering,* v. 29, Jan. 1957, p. 19-20.

A method of comparing the performance of different alloy types under fatigue conditions for which complete data are not available. 4 ref. (Q7; Al)

253-Q. **Effect of Surface Finish on the Fatigue Strength of Titanium Alloys RC130B and Ti 140A.** G. M. Sinclair, H. T. Corten and T. J. Dolan. *American Society of Mechanical Engineers, Transactions,* v. 79, Jan. 1956, p. 89-96. (CMA)

A study of the effect of surface finishing operations on the fatigue strength of RC130B and Ti 140A showed that the fatigue strength varied with the hardness of the surface layer; roughness has a lesser effect. Grinding gave the lowest surface hardness and cold rolling gave the highest. Microhardness was measured and notch properties were tested. The data are evaluated with an equation which is derived. A nomograph is shown. 9 ref. (Q7a, 3-20; Ti)

254-Q. **Elastic Constants in Structural Design With Particular Applications to Titanium.** S. A. Gordon. *Battelle Memorial Institute. Titanium Metallurgical Laboratory. Report* 56, October 1956, 184 p. (PB 121600). Abstracted in: *U.S. Government Research Reports,* v. 27, Feb. 15, 1957, p. 60. (CMA)

Studies are presented to show the effect of changes in elastic constants on the formulas wherein they are used. Design curves for titanium are shown for columns, buckling, torsion in cylinders and crippling of open sections. An analysis is given for some typical beams and columns. (Q21, 17-1; Ti)

255-Q. **The Influence of Understressing on the Fatigue Properties of Flake Graphite and Nodular Graphite Cast Irons.** G. N. J. Gilbert and K. B. Palmer. *British Cast Iron Research Association, Journal of Research and Development,* v. 6, Dec. 1956, p. 410-421.

Fatigue results on irons previously understressed for 20 million cycles at a stress 0.5 ton per sq. in. below the virgin fatigue limit. (Q7, 3-16; CI)

256-Q. **The Impact Properties of Ferritic Nodular Irons in the Ductile and Brittle Condition, Using Standard and B.C.I.R.A. Impact Specimens.**

G. N. J. Gilbert. *British Cast Iron Research Association, Journal of Research and Development*, v. 6, Dec. 1956, p. 422-429.

Impact values with standard Charpy and Izod specimens compared with B.C.I.R.A. ½ x ¾-in. V-notched specimens for research purposes and the ⅜-in. square unnotched specimen.
(Q6n, Q6r, 1-10, CI-r)

257-Q. How Ductile Iron Made Its Place in Machine Design. *Canadian Machinery and Manufacturing News*, Dec. 1956, p. 637-638.

Toughness, castability, wear resistance and tensile and yield strength are properties of ductile iron important in design.
(Q general, 17-1; CI-r)

258-Q. Testing Iron Whiskers. *Chemical and Engineering News*, v. 35, Jan. 14, 1957, p. 22-24.

New Westinghouse method for determining tensile strength of iron whiskers. (Q27a; Fe, 14-11)

259-Q. Stress in Electrodeposits. R. Pinner. *Electroplating and Metal Finishing*, v. 10, Jan. 1957, p. 7-11.

Review of stress in nickel, chromium, zinc, with reference to stress-increasing and stress-relieving agents, temperature, pH and current density. Effects of stress on adhesion, cracking, corrosion, fatigue and magnetic properties of deposit. (Concluded.) 55 ref.
(Q25, L17c; *Ni, Cr, Zn*)

260-Q. Testing Indentation and Abrasive Hardness of Hard Materials. P. Grozinski. *Industrial Diamond Review*, v. 16, Dec. 1956, p. 228-233.

Double cone shapes, selection of double cone diamonds, comparison of the indentation shapes. (To be continued.) (Q29b, Q29c)

261-Q. Nickel-Free Austenitic Stainless Steel. *Materials and Methods*, v. 45, Jan. 1957, p. 104-105.

Properties of Tenelon, a chromium-manganese-nitrogen grade steel, as a replacement for 18-8 nickel-containing grades. (Q general; SS-e)

262-Q. The Effect of Some Mill Additions on the Abrasion Resistance of a Titania-Opacified Enamel. R. H. Ashby and B. K. Niklewski. *Metal Finishing Journal*, v. 3, Jan. 1957, p. 19-28, 38.

Test procedure and equipment for testing abrasion resistance; results and discussion. (Q9n, 1-2, 8-21)

263-Q. Insuring Toughness in Forged Gun Tubes. A. Hurlich and A. F. Jones. *Metal Progress*, v. 71, Feb. 1957, p. 65-70.

Composition of steel for large gun forgings is not specified. Heat treatments can be adjusted by the manufacturer to meet required ductility (reduction of area) and toughness (Charpy impact at −40° F.). Soundness is determined by macroetching.
(Q23, Q6, J general; ST, 4-1, 15-24)

264-Q. Molybdenum as an Alloy Addition for Titanium. Harold Margolin. *Metal Progress*, v. 71, Feb. 1957, p. 86-91.

A 7% Al, 3% Mo alloy has superior strength-weight properties at elevated temperatures. Molybdenum also has favorable influence on hardenability and oxidation resistance. It seems possible that, with its help, a useful age-hardenable alloy can be developed.
(Q general, 2-10; *Mo*)

265-Q. Molybdenum for High Strength at High Temperatures. R. R. Freeman and J. Z. Briggs. *Metalworking*, v. 13, Feb. 1957, p. 50-51. (CMA)

Report to a recent meeting of the American Rocket Society indicated that molybdenum alloys may be top contenders for structural use beyond 1600° F.
(Q27a; Mo, SGA-h, SGB-a)

266-Q. Research on Cumulative Damage in Fatigue of Riveted Aluminum Alloy Joints. J. Schijve and F. A. Jacobs. *National Aeronautical Research Institute, Amsterdam*, no. M. 1999, Jan. 1956, 53 p.

Two-step tests and interval tests on 24 S-T Alclad riveted lap joints. Available data on light alloy "cumulative damage in fatigue" reviewed and compared. (Q7; Al, 7-3)

267-Q. Calculation of the Elastic Shear Constants of Magnesium and Magnesium Alloys. John R. Reitz and Charles S. Smith. *Physical Review*, v. 104, Dec. 1, 1956, p. 1233-1259.

Equations for elastic strain energy for magnesium. Coulomb contributions, Fermi surface, zone contributions, overlap-hole contributions, temperatures effect of elastic shear.
(Q21d; Mg)

268-Q. On the Relation Among Stress, Strain, and Strain Rate in Copper Wires Submitted to Longitudinal Impact. C. Riparbelli. *Proceedings of the Society for Experimental Stress Analysis*, v. 19, No. 1, p. 55-70.

Data from exploratory tests of tensile impact are used for the interpretation of the mechanism of plastic deformation caused by longitudinal impact.
(Q24, Q27b; Cu, 4-11)

269-Q. Fatigue Damage Measured by Deflections of Rotating Beam Specimens. R. G. Crum and E. D'Appolonia. *Proceedings of the Society for Experimental Stress Analysis*, v. 19, No. 1, p. 71-82.

Construction and use of apparatus for continuously recording the mid-span deflection and the energy dissipated during cyclic loading of rotating beam fatigue specimens tested at various speeds. (Q7c)

270-Q. A Fatigue Testing Machine for Reversed Bending and Steady Torque. H. H. Mabie and M. S. Gjesdahl. *Proceedings of the Society for Experimental Stress Analysis*, v. 19, No. 1, p. 83-88.

Machine design, tests on triangular and square shafts with rounded corners, and on round shafts with keyways. (Q7b)

271-Q. Some Metallurgical Aspects of Pontiac V-8 Engine Pearlitic Malleable Iron Crankshaft. K. E. Valentine. *Society of Automotive Engineers, Preprint*, Jan. 1957, 6 p.

Mechanical properties, machining experiences.
(Q general, G17, T21b; CI-s)

272-Q. Metallurgical Designing for Strength. C. Zener. *Tech Engineering News*, v. 38, Nov. 1956, p. 52-57.

Atomic structure and deformation of metals; design principles.
(Q24, M25, 17-1)

273-Q. Effect of Ceramic Coatings on Creep of Alloys. *Technical News Bulletin, U.S. National Bureau of Standards*, v. 41, Jan. 1957, p. 6-7.

Composition of high-temperature ceramic coating and its creep phenomena. (Q3m; 8-21)

274-Q. Results of Practical Trials on Aluminium Tin Bearings. N. Collari and L. Paglialunga. *Tin and its Uses*, Autumn 1956, no. 37, p. 5-7.

The amount of wear in tramcar bearings for three different tin-aluminum alloys is compared.
(Q9n, T7d; Al, Sn)

275-Q Stability of Commercial Alpha-Beta Titanium Alloys. D. A. Wruck. *U.S. Air Force, Wright Air Development Center, Technical Report 56-343*, Aug. 1956, 35 p. (PB 121655). Abstracted in *U.S. Government Research Reports*, v. 27, Jan. 18, 1957, p. 21. (CMA)

The influence on α-β titanium alloy stability of temperature, time-at-temperature, stress and hydrogen content was studied for Ti-140A, Ti-155A, C-130AM, C-110M, Ti-6Al-4V, RS-140X and 3Mn complex. Stability up to the highest temperatures is feasible if the hydrogen content is low. Embrittling mechanisms are considered. The loss of ductility in Ti-150A exposed to 800° F. for 200 hr. may be recovered by annealing at 1200° F. for 24 hr.
(Q23p. Q26s, 2-11; Ti)

276-Q. Investigation of the Compressive, Bearing and Shear Creep-Rupture Properties of Aircraft Structural Metals and Joints at Elevated Temperatures. F. J. Vawter, et al. *U.S. Air Force, Wright Air Development Center, Technical Report 54-270 part 2*, Sept. 1956, 95 p. (PB 121656). Abstracted in *U.S. Government Research Reports*, v. 27, Jan. 18, 1957, p. 19. (CMA)

Tensile creep and bearing creep data and results of sheer-pin deformation tests are presented for titanium alloys A-70 and C-110M, SAE 4130 steel and type 321 stainless steel and other materials.
(Q3m; Ti, AY, SS)

277-Q. Creep and Stress-Rupture Properties of Zirconium; Effect of Annealing Treatment. R. W. Guard and J. H. Keeler. *U.S. Atomic Energy Commission, SO-2524*, May 1956, 20 p. (CMA)

Zirconium creep studies up to 500° C. show that creep is insignificant below yield strength stresses and 300° C. Annealing treatments become effective only above 500° C. Metallographic studies show that twinning is prominent only below 300° C. and that polygonization and boundary deformation are important above 500° C., especially for α-annealed material. The superior creep resistance of the β-annealed material is related to irregular boundary structure and resistance to polygonization. (Q3m, 2-14; Zr)

278-Q. Effect of Cold Work on the Mechanical Properties of Zircaloy-2. F. Forscher. *U.S. Atomic Energy Commission, WAPD-111*, Dec. 18, 1954, 44 p. (CMA)

The influence of cold work was studied for the longitudinal and transverse directions of Zircaloy-2 at temperatures between −195 and 500° C. The normal increase of ductility is halted at about 150° C. and resumes at 350° C. More cold work enhances this trend. The ductility in the transverse direction decreases with temperature between 150 and 350° C. with 25% cold work. Beyond this amount, cold work decreases the ductility. (Q23p, 3-18; Zr)

279-Q. The Problem of Brittle Fracture. Part II. W. D. Biggs. *The Welder*, v. 25, no. 127, July-Sept. 1956, p. 48-55.

General discussion of transition temperature, notch bend, tear, notched tensile, and explosion tests; effects of grain size, composition, structure, prior strain and aging. 28 ref. (To be continued.)
(Q26s, Q23r; 2-9, 2-10, 3-20)

280-Q. Further Studies on Stainless-Steel Hot Cracking. P. P. Puzak and H. Rischall. *Welding Journal,* v. 36, Feb. 1957, p. 57s-61s.

Test data provide additional evidence supporting the hypothesis that grain boundary lignation is responsible for base-metal hot cracking of stainless steels. Short-time high-temperature tensile tests, and nature of fusible segregate compositions. 8 ref. (Q26p, Q3; SS)

281-Q. The Plastic Ductility of Austenitic Piping Containing Welded Joints at 1200° F. R. W. Emerson and R. W. Jackson. *Welding Journal,* v. 36, Feb. 1957, p. 89s-104s.

Investigation includes methods of attack for solving the problem of the choice of material for main steam piping. High-temperature tests and metallurgical examination and mechanism of service failures. 10 ref. (Q23p, 2-12; ST, 4-10, 7-1)

282-Q. (Dutch.) **Practical Aspects of Brittle Fracture of Steel.** G. E. Tummers. *Metalen,* v. 11, Nov. 1956, p. 496-502.

A review of important factors, especially choice of materials, design of structures, conditions of application (temperature, loading rate) and testing methods.
(Q26s, 1-4, 17-1; ST)

283-Q. (French.) **Considerations on the Modulus of Elasticity of Cast Irons and Their Elastic Behavior in General.** Paul le Rolland and Elisabeth Plénard. *Fonderie,* no. 130, Nov. 1956, p. 427-438.

Shows the significance of the modulus of elasticity as an index of the quality of cast iron and discusses the elasticity of solids in general and cast iron in particular. 15 ref. (Q21; CI)

284-Q. (French.) **Results of Tests on Cast Iron With Copper.** Pierre Detrez. *Fonderie,* no. 130, Nov. 1956, p. 456-463.

Analysis of the properties of cast iron containing varying amounts up to 3% of copper from the point of view of tensile strength, hardness, resilience and modulus of elasticity. (Q general, 2-10; CI, *Cu*)

285-Q. (French.) **Measurement of the Modulus of Elasticity of Cast Iron by Various Methods and Comparison of the Results.** Paul le Rolland and Elisabeth Plénard. *Fonderie,* no. 131, Dec. 1956, p. 477-495.

Investigation of the modulus of elasticity of cast iron by three methods—static, pendulum and dynamic. (Q21a, 1-4; CI)

286-Q. (French.) **Special Cast Irons in the Construction of Diesel Motors.** Jean Gonin and Gerard de Smet. *La Machine Moderne,* no. 574, Jan. 1957, p. 33-38.

Analysis of the chemical and mechanical properties of cast irons to determine the best composition for use in conditions involving high speeds, stress and temperature.
(Q general, W11, 17-7; CI)

287-Q. (French.) **Fatigue in Metals Under the Influence of Combined Stresses.** Wm. N. Findley. *Revue de la Société Royale Belge des Ingénieurs et des Industries,* Dec. 1956, p. 451-465.

Review of available information on fatigue phenomena. Several theories of fracture under the effect of combined stresses examined and modified to take into account verified data; general formula suggested. Influence of average stresses (including very high compression), cold extrusion, other normal tensions, anisotropy. 12 ref. (Q7f, 3-16)

288-Q. (German.) **Timing for Forgings as a Function of Resistance and Reheating Time.** E. Pflaume. *Fertigungstechnik,* v. 6, Dec. 1956, p. 541-543.

The influence of the varying deformation resistance of alloyed and unalloyed steels in obtaining a standard by means of a flux. On the basis of heated compression tests numerical values are obtained which together with metallurgically accepted temperature tolerances show usable flux values for forgings.
(Q24, F22; CN, AY)

289-Q. (German.) **The Influence of Storage at Room Temperature and Annealing on the Hydrogen Content, on Tensile Strength, Especially Elongation and Reduction Area of Solidified Welds.** Jakob Colbus. *Zeitschrift für Schweisstechnik,* v. 47, Jan. 1957. p. 14-18.

Welds from different electrodes are tested for hydrogen content and tensile strength. The testing is done immediately after welding, after storage for 6 weeks and after annealing at 250° C. for 6 to 16 hr. The dependence of the tensile strength, elongation and reduction of area upon the hydrogen content is determined. 4 ref. (Conclusion.)
(Q27a, 2-14; ST, *H*, 7-1)

290-Q. (Japanese.) **Deformation Resistance of High-Temperature Steels at 800, 900 and 1000° C.** Shoji Terai. *Sumitomo Metals,* v. 8, Oct. 1956, p. 221-228.

Strain-time curves at various temperatures under the different stresses, and the determination of deformation resistance based on the assumption that transient creep would be faint at testing temperature. 7 ref.
(Q24, 2-12; ST, SGA-h)

291-Q. (Russian.) **Relationship of Composition, Temperature and Heat Stability. III. Quinternary System Alloys Nickel-Chromium-Tungsten-Aluminum-Titanium.** I. I. Kernilov and F. M. Titov. *Izvestiva Akademii Nauk SSSR. Otdeleniye Tekhnicheskikh Nauk,* no. 10, Oct. 1956, p. 117-122.

Studies the relationship of composition, structure and heat stability of alloys of quinternary system nickel-chromium-tungsten-aluminum-titanium alloys in the temperature range of 600-1250° C. All of the alloys had the same chromium, tungsten and aluminum content (20%, 6% and 4.5% respectively), while the titanium content varied with the nickel from 0 to 10.0%. Smelting was conducted in a high-frequency laboratory furnace.
(Q general, 2-12; Ni, *Ti, Cr, W, Al*)

292-Q. (Report.) **Effect of Ceramic Coatings on the Creep Rate of Metallic Single Crystal and Polycrystalline Specimens.** J. R. Cuthill and W .N. Harrison, National Bureau of Standards (Wright Air Development Center). 53 p. April 1956. U. S. Office of Technical Services, P.B. 121493. $1.50.

Significant improvements in the creep characteristics of 80-20 Ni-Cr alloys at 1975° is reported for National Bureau of Standards No. N-143 ceramic coatings.
(Q3n; Ni, SGA-h, 8-21)

293-Q. (Report.) **Study of the Possibility of Reinforcing High-Temperature Alloys by Addition of Refractory Powders.** J. D. Burney, P. R. Mallory and Co. Inc. (Wright Air Development Center). 42 p. May 1956. U.S. Office of Techinical Service, P.B. 121474. $1.25.

Greatly improved stress-rupture characteristics, compared to 80-20 Ni-Cr were indicated for alloy reinforced with 1% alumina and densified by a liquid phase sintering technique. (Q23m, H15; Ni, SGA-h)

294-Q. (Book.) **Alcoa Aluminum Handbook.** 175 p. 1956. Aluminum Co. of America, Pittsburgh 19, Pa.

Tables of mechanical properties and specifications for wrought alloys, sheet and plate, wire, rod and bar, extrusions, tube and pipe, electrical conduction, structural shapes, forgings and casting alloys.
(Q general, S22; Al)

295-Q. (Book.) **Bibliography of the Material Damping Field (With Abstracts and Punched Card Codings).** L. J. Demer. 100 p. June 1956. U.S. Office of Technical Services, P.B. 121437. Washington 25, D.C.

Consists of over 900 references in the field of damping of materials and structures. Entries are coded according to a classification based on the *ASM-SLA Metallurgical Literature Classification.* The classification scheme and its indexes are described. (Q22, Q8, A14d; 11-15)

296-Q. (Book.) **Data on Creep and Heat Resisting Steels.** 88 p. Samuel Fox and Co., Ltd., Stockbridge Works, England.

Data sheets on heat treatment, mechanical properties, creep rupture tests and relaxation tests.
(Q3, J general; SS, SGA-h)

297-Q. (Book.) **Friction and Lubrication.** F. P. Bowden and D. Tabor. 150 p. 1957. John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $2.25.

Modern work and views on the mechanism of friction and lubrication; fundamental concepts and theory. Written for engineers, physicists and metallurgists.
(Q9p, 18-23)

298-Q. (Book.) **Proceedings of the Society for Experimental Stress Analysis.** C. V. Mahlmann and W. M. Murray, editors. v. 14, No. I, 214 p. 1956. Society for Experimental Stress Analysis, Central Square Station, P.O. Box 168, Cambridge 39, Mass.

A collection of 24 papers; pertinent ones are abstracted individually. (Q25, Q general)

R Corrosion

63-R. The Effect of Heat Treatment on the Susceptibility of Sand Cast Aluminum Alloy 220 to Stress-Corrosion Cracking. Fred M. Reinhart. *Corrosion,* v. 13, Jan. 1957, p. 17-18.

Susceptibility decreased with increased rate of quenching from the solution heat treating temperature.
(R1d, 2-14; Al)

64-R. Analysis of Corrosion Conditions Using Cable Sheath Current Measurements. J. M. Fouts and C. W. Bergerson. *Corrosion,* v. 13, Jan. 1957, p. 28-32.

"Zero Resistance Ammeter Method" for making large numbers of sheath current measurements is described. Application of current measurement data to corrosion analysis is discussed in detail. (R11m, T7g)

65-R. Effect of Hot Hydrogen Sulfide Environments on Various Metals. Frank J. Bruns. *Corrosion,* v. 13, Jan. 1957, p. 43-52.

Refinery corrosion tests of alloy steels and aluminum coated carbon steels were made and corrosion rates plotted, indicating that low-chromium steels are satisfactory provided the hydrogen sulphide-hydrogen ratio is lower than 100 ppm. Aluminum coated steels proved to have marked resistance to attack with best results achieved with calorized coatings. 11 ref. (R7k; AY, ST, *Al*)

66-R. High Temperature Sulfide Corrosion in Catalytic Reforming of Light Naphthas. Cecil Phillips, Jr. *Corrosion,* v. 13, Jan. 1957, p. 53-58.

Corrosion rates during operation on heavy naphtha varied from 0.15 to 0.4 in. on carbon steel and chromium alloys but the rate on 18-8 was about one-tenth that of the other metals. Chromium alloys through 12% in many instances showed corrosion rates higher than those of carbon steels. Aluminized steel generally showed good resistance at H_2S concentrations under 0.008 mol. percent. 7 ref. (R7k; CN, SS, *Al*)

67-R. Electrical Resistance Corrosion Measurements Employing Alternating Current. Wayne L. Denman. *Corrosion,* v. 13, Jan. 1957, p. 59-66.

Equipment and procedures discussed. Corrosion calculated from voltage drops, with increases in drop values directly proportional to amount of corrosion. 10 ref. (R11m)

68-R. Analysis of Corrosion Pitting by Extreme-Value Statistics and Its Application to Oil Well Tubing Caliper Surveys. G. G. Eldredge. *Corrosion,* v. 13, Jan. 1957, p. 67-76.

Detailed directions are given for the use of a special graphical method, known as the Pit Depth Rank Chart. 11 ref. (R2j, S12)

69-R. Corrosion of Structural Materials in High Purity Water. A. H. Roebuck, C. R. Breden, and S. Greenberg. *Corrosion,* v. 13, Jan. 1957, p. 87-90.

Materials showing the highest corrosion resistance included austenitic stainless steels, precipitation hardening stainless steels, cobalt alloys, platinum, titanium, zirconium, and hafnium. Those showing lowest resistance were copper, bronzes, magnesium, plain carbon steels and silver. 4 ref. (R4e; SS, Co, Pt, Ti, Zr, Hf)

70-R. Corrosion Engineering Problems in High Purity Water. D. J. DePaul. *Corrosion,* v. 13, Jan. 1957, p. 91-96.

Attention is given to crevice, galvanic, intergranular and stress-corrosion as a function of the metals studied, which included 18-8 type stainless steel, cobalt base alloys, hard chromium plate, copper base alloys, nickel base alloys and straight chromium stainless steels. (R4e; SS, Co, Cu, Ni, *Cr,* 8-12)

71-R. The Importance of High Purity Water Data to Industrial Applications. W. Z. Friend. *Corrosion,* v. 13, Jan. 1957, p. 97-101.

A review of available information on plant experience indicates that corrosion resistant metals such as stainless steels, nickel alloys, or aluminum are generally required to handle high purity water. 27 ref. (R4e; SS, Ni, Al)

72-R. Corrosion Problems Arising From the Use of Aluminum Alloys in H.M. Ships (2). J. C. Kingcome. *Corrosion Prevention and Control,* v. 3, Dec. 1956, p. 37-40.

Examples of corrosion: wrong choice of alloy, faulty design, contact with steel, contact with copper alloys. (R general, T22; Al)

73-R. Pitting Corrosion of Reserve Fleet Ships. E. F. Corcoran and J. S. Kittredge. *Corrosion Prevention and Control,* v. 3, Dec. 1956, p. 45-48.

Sewage into San Diego Bay, resulting in oxygen supersaturation responsible for electrochemical corrosion of ships' plating. 12 ref. (R2j, T22g; ST)

74-R. Protective Film on Titanium in Hydrochloric Acid. Rikuro Otsuka. *Journal of Metals,* v. 9, Jan. 1957, p. 75-76.

Experiments indicate film may be a hydride. Techniques are discussed which are believed to produce hydrides or to remove them prior to hydrochloric acid tests. 4 ref. (R10c, R6g; Ti)

75-R. Corrosion Testing of Zirconium, Zircaloy and Hafnium. J. S. Theilacker. *U.S. Atomic Energy Commission. AECU-3260,* May 26, 1956, 6 p. (CMA)

Specifications are given for the corrosion testing of core components, and for quality control coupons. Procedures for testing, handling of equipment and precautions for handling radioactive materials are discussed. A schedule is presented for the testing of various items. (R11, A7r; Zr, Hf)

76-R. The Effect of Cold and Hot Drawing on the Corrosion Resistance of Zircaloy-2. H. J. Snyder. *U.S. Atomic Energy Commission. WAPD-FE-896,* June 30, 1955, 10 p. (CMA)

Hot and cold-drawn samples of Zircaloy-2 were subjected to 750° F. steam for 86 days. Drawing 54% by either the hot or cold method had no effect on the corrosive weight gain beyond the normal 77 mg. per sq. dm. Methods of restoring corrosion resistance to Zircaloy-2 after fabrication were considered. Tests showed that the removal of 0.004 in. from the surface by abrasion or 0.0003 in. by etching with 35% HNO_3-5% HF at 160° F. would restore the normal corrosion resistance. (R general, 3-18; Zr)

77-R. The Oxidation of Zirconium and Zirconium Alloys in Air. H. R. Hoge. *U.S. Atomic Energy Commission. WAPD-MDM-11,* May 24, 1954, 28 p. (CMA)

A study of the practical limit for heating strips of zirconium and zinc alloys involved experimentation and a survey of the literature. Ingots may be safely heated to 1800° F. but strip should not be heated in air above 1500° F. The rate of oxidation increases with temperature until oxygen diffuses into the center of the strip; excessive warping also occurs. 3 ref. (R1h; Zr)

78-R. Report of October 1954 Meeting of the Zirconium Alloy Corrosion Committee. S. Kass. *U.S. Atomic Energy Commisssion. WAPD-MM-713,* Nov. 30, 1954, 133 p. (CMA)

Reports are given on the Zircaloy-3 development program, including corrosion resistance and mechanical properties. The alloys, which are variations on the Zircaloy-2 composition, are promising. Corrosion resistance is adversely affected by Ti, Cb, Mo, Cu, W, Al and Mn; beryllium had no effect and cobalt was beneficial. Sample thickness had no effect and tests in 800, 850 and 900° F. steam showed poor correlation between pressure and corrosion. Resistance was good at 550, 600, 680 and 750° F. after 350-430 days. Weight gain at "breakaway" increases with temperature. (R general, 2-10; Zr)

79-R. Evaluation of Hafnium Crystal Bar. R. B. Stermon. *U. S. Atomic Energy Commission, WAPD-TN-521,* Aug. 1955, 41 p. (CMA)

Hafnium crystal bar was evaluated for corrosion resistance in its application as a control rod in a statistical way. All specimens except those in the "very bad" category had adequate corrosion resistance and mechanical properties. Dilution with "good" material may be feasible in producing acceptable stock. The procedures are described. (R general, Q general, T11j; Hf)

80-R. (German.) **Scaling of Pure Iron and Scaling in General.** Norbert G. Schmahl, Hans Baumann and Hermann Schenck. *Archiv für das Eisenhüttenwesen,* v. 27, Nov. 1956, p. 707-713.

Excess temperatures caused by the heat of reaction of the scaling process are recognized as the reason for deviations from the parabolic scaling law. 28 ref. (R1h; Fe-a)

81-R. (German.) **Formation of a Protective Layer on Titanium in Hydrochloric Acid.** *Zeitschrift für Metallkunde,* v. 47, no. 11, Nov. 1956, p.714-715. (CMA)

Samples cut from rolled and polished titanium sheets were immersed for 7 days at room temperature in hydrochloric acid of various concentrations. It was observed that a corrosion resisting coating was formed whose properties depended on the concentration of the acid; the density and mechanical strength of coatings increased with decreasing HCl concentration. Electron diffraction diagrams showed that the coatings consisted of titanium hydrides. 8 ref. (R10c, R6g; Ti)

82-R. Corrosion of Titanium. D. W. Stough, F. W. Fink and R. S. Peoples. *Battelle Memorial Institute. Titanium Metallurgical Laboratory. Report 57,* Oct. 1956, 184 p. (PB 121601) Abstracted in: *U.S. Government Research Reports,* v. 27, Feb. 15, 1957, p. 60. (CMA)

The corrosion properties of titanium and its alloys are reported including corrosion rates in a number of environments. Industrial and military experiences with titanium corrosion are cited. The passivating processes of titanium were studied. (R general; Ti)

83-R. Cathodic Protection for Small Shipping. M. G. Duff and I. D. G. Graham. *Corrosion Technology,* v. 4, Jan. 1957, p. 9-12.

Discussion of anodes and anode requirements for small vessels, such as small bulk, low output and relatively long working life. (R10d)

84-R. Mercury Compositions on Aluminum Alloy Hull Plating. E. G. West. *Corrosion Technology,* v. 4, Jan. 1957, p. 13-14.

Corrosion results on the hull of an aluminum alloy motor boat, coated with anti-fouling composition containing mercury, and suggested remedial measures. 3 ref. (R4b; Al)

85-R. Corrosion Congress, Paris, Nov. 1956. *Corrosion Technology,* v. 4, Jan. 1957, p. 25-28.

Abstracts of papers presented covering various fields of corrosion technology and a symposium on aluminum corrosion. (R general; Al)

86-R. Controlling Corrosion. T. J. Hull. *Industrial and Engineering*

Chemistry, v. 49, Jan. 1957, p. 103A-104A.

Titanium and tantalum as corrosion resistant materials; hydrogen sulphide corrosion in oil refinery catalytic reformers; and measurement of instantaneous corrosion rate. 4 ref. (R7k; Ti, Ta)

87-R. High Temperature Oxidation Characteristics of Some Manganese Steels: Part II. Ved Prakash and A. A. Krishnan. *Journal of Scientific and Industrial Research,* v. 15B, Oct. 1956, p. 600-607.

Metallography of the oxides formed at 600 and 700° C., effect of temperature on oxidation of manganese-aluminum steel, influence of composition. 10 ref. (R1h, M27, 2-12; ST, *Mn, Al*)

88-R. Nomograph Gives Numerical Estimation of Galvanic Corrosion. Harold Blye. *Machine Design,* v. 29, Jan. 10, 1957, p. 139.

Nomograph of galvanic corrosion and its use. (R1a)

89-R. Corrosion Is a Complex Problem for Refiners. Part I. Thomas M. Krebs. *Oil and Gas Journal,* v. 55, Jan. 14, 1957, p. 131.

Presentation of corrosion of ferrous tubing materials. To be continued. (R7a; Fe, 4-10)

90-R. Temporary Protective Coatings for Metals. Five Essential Requirements. E. Strong. *Product Finishing,* v. 10, Jan. 1957, p. 79-91.

Data on performance of corrosion inhibitors and their chemical and physical characteristics. (R10f)

91-R. An Investigation of Scaling of Zirconium at Elevated Temperatures. Quarterly Status Report No. 14. E. B. Evans and W. M. Baldwin, Jr. *U.S. Atomic Energy Commission. AECU-3382,* Dec. 4, 1956, 7 p. (CMA)

Instantaneous scaling rates of zirconium were calculated for various media and duplex treatments. The distribution of nitrogen and/or oxygen reacting with zirconium was studied; the gas is distributed during scaling between the scale and the metal (outer layers). Depth of absorption depends on scaling temperature and time; oxygen penetrates faster than nitrogen. The amount of gas dissolving before the break in scaling rate at 900° C. is the same as that dissolving afterwards. (R2q, 2-12; Zr)

92-R. Scaling of Zirconium at Elevated Temperatures. Technical Progress Report No. 3. E. B. Evans and W. M. Baldwin, Jr. *U.S. Atomic Energy Commission, AECU-3386,* Dec. 1956, 32 p. (CMA)

High-temperature scaling studies for zirconium reveal spectacular effects when scaling occurs in air within a critical temperature range: extreme dilation laterally, increased scaling rate, and a change from dense black scale to white porous scale. These phenomena depend on time, temperature, gas composition, and shape, thickness and purity of the sample. The critical range is 600-1050° C. None of the phenomena occurred in pure gas. The role of each of the variables was investigated. (R2q, 2-12; Zr)

93-R. The Corrosion Behavior of Some Zirconium-8 Wt. % Uranium Alloys of 680° F. Water. D. C. Belouin. *U.S. Atomic Energy Commission, KAPL-M-DCB-1,* Dec. 5, 1956, 16 p. (CMA)

Static corrosion tests were conducted in 680° F. water; results are reported for 4000 hr. of testing. Quenching the alloy from 1000° C. gives a more corrosion resistant structure than annealing at 575° C. An important effect on corrosion is indicated for minor alloying elements. Frequent inspection greatly affected the corrosion rate. (R4a, 2-10; Zr, *U*)

94-R. An Investigation of Scaling of Zirconium at Elevated Temperatures. Quarterly Status Report No. 12 for March 2, 1956 to June. C. A. Barrett, et al. *U.S. Atomic Energy Commission, AECU-3257,* June 11, 1956, 4 p. (CMA)

Sintering and self-heating effects and the role of hydrogen were studied in an investigation of zirconium scaling at high temperature. No exothermic reaction was observed on the breakaway of scales, nor did scales sinter after heating in air to 1100° C. for 24 hr. Hydrogen pickup from pickling in H_2SO_4 was shown to have no significant effect on scaling unless saturation is complete. (R2q, 2-12; Zr)

95-R. The Relative Corrosion Resistance of Titanium and Some of Its Alloys. L. B. Golden, W. L. Acherman and D. Schlain. *U.S. Bureau of Mines, Report of Investigations 5299,* Jan. 1957, 25 p. (CMA)

The alloys Ti-7.6Mn, Ti-1.8Cr-O.9 Fe and Ti-2.7V-2.7Fe were evaluated and compared with titanium for corrosion resistance in H_2SO_4, HCl, H_3PO_4, HNO_3, mixed acids and chloride solutions. HCl is less corrosive to powder metallurgy titanium than to arc-melted titanium, but the situation is reversed for H_2SO_4 and H_3PO_4. Ti-2.7V-2.7Fe is more resistant but the others are less so. Embrittlement is proportional to the corrosion rate. Corrosion studies of Ti-Zr alloys show improved resistance with increased zirconium content. 26 ref. (R6g; Ti)

96-R. High Pressure Oxidation of Metals. Technical Report No. 6. Molybdenum in Oxygen. R. C. Peterson and W. M. Fassell. *University of Utah, Department of Metallurgy, Report for Department of the Army Project 599-01-004,* Sept. 1954, 19 p. (PB 123817). Abstracted in *U.S. Government Research Reports,* v. 27, Jan. 18, 1957, p. 19. (CMA)

The temperature and pressure dependence of the corrosion of molybdenum in oxygen was studied in the ranges 525-700° C. and 1-47.6 atm. Molybdenum oxidizes linearly from 525 to 650° C. at all pressures. (R1h, 2-11, 3-24; Mo)

97-R (French.) **A Study of the Oxidation in Air of Kroll Zirconium in the Heated State.** Jean Hérenguel, Donald Witwham and Jacques Boghen. *Académie des Sciences, Comptes Rendus des Séances,* v. 243, Dec. 17, 1956, p. 2060-2063. (CMA)

The known phenomenon of the oxidation in air of Kroll zirconium in the heated state, resulting in various volume increases of the sample depending on the temperature and sample thickness, may be explained by the fact that the resistance of zirconium to flow decreases considerably above 400-500° C. and that the transformation of zirconium into the oxide is accompanied by a volume increase of about 50%. It is indicated that generally the self protection of a metal, achieved by a layer formed when the volume is increased, ceases in the temperature range of viscous deformation. To increase this self protection attempts should be made to increase the resistance of the metal to flow or to render the protecting layer more viscous. 1 ref. (R1h; Zr)

98-R. (German.) **Corrosion Tests With Simultaneous Emanation Effect.** K. Lintner, E. Nachtigall and E. Schmid. *Metall,* v. 11, Jan. 1957, p. 31-35.

Damage due to corrosion, in the health tunnel at Boeckstein, led to experiments in which it was shown the hydrogen peroxide present in addition to salt and moisture caused increased corrosion of iron and aluminum. Radioactive emanations in the tunnel may increase the hydrogen peroxide content and thereby corrosion. 2 ref. (R6p, 2-17; Fe, Al)

99-R. (Italian.) **Factors in the Evaluation of the Corrosivity of Waters.** G. Bombara and F. Gianni. *Metallurgia Italiana,* v. 48, Nov. 1956, p. 503-512.

Natural waters and inhibited waters and solutions studied for effects on ordinary construction steel at ambient temperature. Concludes impossibility of defining corrosivity of an electrolytic medium on a given metal unless all corrosion conditions specified; that most adequate method appears to be determination of break point on cathode polarization curve. 11 ref. (R4, R11m; CN)

100-R. (Report.) **Solubility and the Products of Reaction Between Iron and Water at 26° and 300° C.** V. J. Linnenbom, J. I. Hoover and H. S. Dreyer. 15 p. Sept. 1956. U.S. Naval Research Laboratory, U.S. Office of Technical Services, P.B. 121409, Washington 25, D. C. $.50.

Deposits of magnetite resulting from a water-iron reaction in a pressurized water reactor whose primary coolant vessel is of stainless or low-carbon steel. (R4, T11; Fe, Cn-g, SS)

S Inspection and Control

64-S. Turbidimetric Determination of Chlorine in Titanium. H. J. G. Challis and J. T. Jones. *Analyst,* v. 81, no. 969, Dec. 1956, p. 703-708. (CMA)

A method has been developed for estimating the chlorine in titanium by turbidimetry of AgCl in an absorptiometer; advantages are speed, simplicity and applicability to routine control. Comparison is made with the gravimetric method. Recovery of chlorine is satisfactory over the range 0.0001-0.0075 g. of chlorine. The procedure is given, including sampling precautions. (S11; Ti, *Cl*)

65-S. International Agreement Sought on Specifications for Gray Iron. H. W. Lownie Jr. *Foundry,* v. 85, Feb. 1957, p. 120-122.

Proposed international specifications dealing with the properties of iron in test bars in some ways resembles ASTM, A-48 specifications. (S22; CI-n)

66-S. Surveyor's Viewpoint on Steel Castings. S. F. Dorey, *Iron and Steel,* v. 30, Jan. 1957, p. 25-27.

Inspection methods, incidents and types of defects and repair of faults. (S13; ST, 5, 9)

67-S. Control by Quantameter. *Iron and Steel,* v. 30, Jan. 1957, p. 30.

Recording spectrometer at Samuel Fox and Co., Ltd., aids production control by rapid analysis of steel. (S11k; ST)

68-S. Monitor Measures Oxygen Content in Flue Gases to Give Peak Combustion Efficiency. *Iron and Steel Engineer,* v. 34, Jan. 1957, p. 172-174.

Basic components and use of multiple probes for average sample of monitor systems. (S11r)

69-S. Symposium on Titanium III. Analytical Developments. S. Vigo. *Journal of Metals,* v. 9, Jan. 1957, p. 173-177. (CMA)

The program of cooperative research on the analysis of additions and impurities of titanium is described. Determinations of oxygen by the methods of spectroscopy, bromination, chlorination and vacuum fusion are compared. Typical task force results are presented for chromium, molybdenum, iron, vanadium, manganese, tin and nitrogen. Analytical methods are compared in the analysis of Ti-6Al-4V. (S11; Ti)

70-S. The Alcohol-Iodine Method for the Extraction of Inclusions From Steel. J. E. Garside, T. E. Rooney and J. J. J. Belli. *Journal of the Iron and Steel Institute,* v. 185, Jan. 1957, p. 95-103.

Review of development of method. Apparatus and procedure. Preparation of samples and analysis of residues. Application to various types of steel. 16 ref. (S11; ST, 9-19)

71-S. Production Control Quantometer for Steelworks Analysis. D. Manterfield and W. S. Sykes. *Journal of the Iron and Steel Institute,* v. 185, Jan. 1957, p. 105-113.

Principles involved and a description of the instrument and its scope. Iron is used as an internal standard for steel analysis and the instrument calibrated against standard samples of known composition. Results are equal in accuracy to those obtained by chemical methods. 10 ref. (S11c; ST)

72-S. International Standards for Wrought Light Alloys. Part VII. Indian Standards. *Light Metals,* v. 20, Jan. 1957, p. 24.

Indian standards on wrought aluminum for utensils, aluminum sheets and coils for aircraft purposes, aluminum-magnesium alloy sheets and coils. (S22; Al, 15-11)

73-S. Quality Control of High-Temperature Alloys. G. T. Harris. *Metal Progress,* v. 71, Jan. 1957, p. 90-94.

If the variation in properties of high-temperature alloys were reduced, the alloys could be used at higher temperatures or higher stress levels than are now safe. Vacuum melting appears to be one method of reducing the variation. (S12, C25; SGA-h)

74-S. Recent Uses of Radioactive Isotopes in Britain. John F. Cameron. *Metal Progress,* v. 71, Jan. 1957, p. 103-108.

Difficult problems in thickness gaging have been solved with instruments using beta rays and the backscattering of gamma rays. Trace impurities are estimated by irradiating the sample and measuring the induced radiations and their rate of decay. (S19, S11q, S14e; 14-13)

75-S. The Volumetric Determination of Antimony in Antimony-Lead Alloys. E. G. Brown, I. P. Forshaw and T. J. Hayes. *Metallurgia,* v. 55, Jan. 1957, p. 45-47.

A rapid volumetric method for the determination of up to 12% antimony in hard lead. 5 ref. (S11j; Pb, *Sb*)

76-S. A Thermocouple for High Temperatures. Advantage of the "Five-Twenty" Couple. J. C. Chaston. *Platinum Metals Review,* v. 1, No. 1, Jan. 1957, p. 20-22.

A 5% rhodium-platinum; 20% rhodium-platinum couple can be used continuously up to about 1700° C. with absolute limit for single determinations at approximately 1825° C. (S16j; SGA-a)

77-S. Spectrographic Determination of Impurities in Zirconium. J. A. Norris. *U.S. Atomic Energy Commission. MIT*-1049, June 30, 1950, 41 p. (CMA)

A method for the spectrographic analysis of zirconium consists of three alternatives: complete combustion of the sample to estimate hafnium, a partial combustion with graphite buffer for high impurity concentrations, and a pyro-electric combustion with a complex buffer carrier mixture for low impurity concentrations. Sample preparation is described. Time of line persistence is given for several common impurities. (S11k; Zr, 2-1)

78-S. Eddy-Current Testing of Zircaloy Tubing. H. M. Schadel, Jr. *U.S. Atomic Energy Commission. WAPD-PWR-FE*-1134, Dec. 8, 1955, 34 p. (CMA)

Eddy-current equipment was tested for production use with Zircaloy-2 tubing for reactor use. Effects of residual cold work, hardness, wall thickness, transverse and longitudinal flaws, and foreign matter were evaluated. Inspection criteria are presented which permit rapid detection of 85% of the flaws. (S13h; Zr, 4-10)

79-S. Application of Gamma-Radiography. L. Spiro. *Welding and Metal Fabrication,* v. 25, Jan. 1957, p. 21-23.

Describes radiation sources; source containers and exposure methods for weld inspection. (S13e; 1-7)

80-S. (German.) **Highly Sensitive Determination of Carbon With a Recording Conductivity Apparatus.** Walter Koch and Hanns Malissa. *Archiv für das Eisenhüttenwesen,* v. 27, Nov. 1956, p. 695-699.

A procedure developed by Schmidts and Baasch is applied to steel analysis including micro and trace analysis. The kinetic course of the carbon combustion can be followed and irregularities can be recognized. The average error of a measurement is very low. 13 ref. (S11g; ST, CI, *C*)

81-S. (German.) **Rapid Determination of Iron in Slag.** Hermann-Josef Kopinek. *Archiv für das Eisenhüttenwesen,* v. 27, no. 12, Dec. 1956, p. 753-760.

An X-ray spectroscopic method using a commercial X-ray unit for the rapid determination of iron in Thomas slags is described. The iron content can be determined with an accuracy of ± 2%. The analysis takes 4 min. from sampling to transmission of the result. 13 ref. (S11p; RM-q, *Fe*)

82-S. (German.) **Procedure for the Rapid Determination of Arsenic in Ores, in Nonmetallic Materials and in Nitric Acid Resistant Iron Alloys.** Heinrich Ploum. *Archiv für das Eisenhüttenwesen,* v. 27, Dec. 1956, p. 761-766.

The decomposition of samples containing trivalent arsenic with a mixture of nitric and hydrofluoric acid causes loss of arsenic. An oxidizing fusion is used instead and the arsenic can be coprecipitated with iron (III) oxide hydrate, if necessary. The arsenic is distilled with zinc chloride and determined potentiometrically. 1 ref. (S11; *As*)

83-S. (German.) **Electrochemical Test of the Tin and Passivation Layers on Tinplate.** Walter Katz. *Stahl und Eisen,* v. 76, Dec. 13, 1956, p. 1672-1678.

Electrochemical methods are well suited to determination of layer thickness of tinplate and may be used successfully for testing of alloys and for technical control of the product. Tinplate can be identified by thickness of the alloy layer as well as by crystal formation. Passivation layer thickness is determined by electrochemical reduction and takes place according to a logarithmic rule. 19 ref. (S14c; *Sn,* 8-12)

84-S. (German.) **Temperature Measurement in the Drawing of Steel Wire. Part I.** Werner Lueg and Karl-Heinz Treptow. *Stahl und Eisen,* v. 76, Dec. 13, 1956, p. 1690-1698.

A review of former investigations. Materials tested, equipment for and execution of the tests. Test results: comparative calibration of the temperature measuring apparatus, drawing tests. Comparisons of the different testing methods. 27 ref. (S16, F28; ST)

85-S. (Japanese.) **Research on Granite From the Geologic Point of View.** Rokuro Kuroda. *Nippon Kagaku Zassi,* v. 77, Aug. 1956, p. 1129-1142.

Methods and results of chemical analysis of granites; determination of nickel and lead. (S11; NM-f44, *Ni, Pb*)

86-S. (Japanese.) **Distribution of Tungsten in Granite Minerals in Japan.** Rokuro Kuroda. *Nippon Kagaku Zassi,* v. 77, Aug. 1956, p. 1142-1145.

Determination of tungsten in granite, methods and results of chemical analysis. (S11; NM-f44, *W*)

87-S. (Russian.) **Chromatographic Separation of Radioisotopes of Elements of the Yttrium Group Obtained by the Splitting of Ytterbium and Hafnium With High-Energy Protons.** A. A. Pozdnyakov, V. I. Vernadskiy. *Zhurnal Analiticheskoy Khimii,* v. 11, Sept.-Oct. 1956, p. 566-571.

Separation of Lu^{177}, Yo^{175}, Tu^{170}, Er^{171}, and Ho^{166} formed by the irradiation of the corresponding rare earth oxides with slow neutrons. (S11q, 2-15; 14-13, EG-g)

88-S. Flaw Detection. *Aircraft Production,* v. 19, Jan. 1957, p. 27.

Permanent recording of flaw-patterns using adhesive tape. (S13, 1-2)

89-S. The Determination of Iron in Iron Ores, Slags and Refractories by Thioacetamic Reduction. P. H. Scholes. *The Analyst,* v. 81, Dec. 1956, p. 688-693.

The reduction of iron solution by hydrogen sulphide formed in situ by the hydrolysis of thioacetamide. The determination of iron in iron ores and results by thioacetamic process. 6 ref. (S11; Fe, 14-9)

90-S. Determination of Rare Earth Elements and Thorium in Magnesium With Photoelectric Recording Spectrometer. E. J. Hunemorder and T. M. Hess. *Analytical Chemistry,* v. 29, Feb. 1957, p. 236-238. (CMA)

A spectroscopic method for the lanthanons and thorium in magnesium-base alloys is described and is evaluated statistically. The coefficients of variation shown indicate that the results are acceptable. The instrument used should be capable of resolving the lines Ce 4149.9 and Zr 4149.2. The method employs direct sparking of self-electrodes and photoelectrically records

spectral line intensities. Metallurgical history has little effect, but alloy environment is important in the cerium and thorium determinations. 6 ref. (S11a; Mg, *Th, EG-g*)

91-S. Determination of Vanadium in Titanium-Tetrachloride and Titanium Alloys. W. H. Owens, C. L. Norton and J. A. Curtis. *Analytical Chemistry,* v. 29, Feb. 1957, p. 243-245. (CMA)

A spectrophotometric procedure has been developed for determining trace vanadium in $TiCl_4$ and added vanadium in titanium alloys. Chromium interferes. A relative accuracy of 2% can be obtained with rapidity. Color fading due to moisture is easily prevented. (S11a; Ti, *V*)

92-S. Vacuum Fusion Determination of Oxygen and Nitrogen in Lanthanum. D. T. Peterson and D. J. Beerntsen. *Analytical Chemistry,* v. 29, Feb. 1957, p. 254-257. (CMA)

The vacuum fusion method was modified for use with lanthanum; a nickel bath at 1900° C. is employed, since temperatures below 1825° C. do not give accurate results. The evolved gas is then subjected to mass spectrometry. Nitrogen may be simply determined by a nickel bath at 1600° C. 4 refs.
(S11c, 1-23; La, *O, N.*)

93-S. Analytical Solvent Extraction of Molybdenum Using Acetylacetone. J. P. McKaveney and H. Freiser. *Analytical Chemistry,* v. 29, Feb. 1957, p. 290-292. (CMA)

Acetylacetone selectively extracts Mo(VI) from ferrous material. Employing a solution 6*N* in H_2SO_4 precludes extraction of copper, tungsten and chromium. Results are somewhat empirical since they are multiplied by 1.04 to compensate for 96% extraction. Molybdenum is determined colorimetrically as the thiocyanate. The MO(VI)-acetylacetone complex might be used colorimetrically if the molybdenum level is high. 8 ref. (S11, *Mo*)

94-S. Pyrohydrolytic Determination of Chloride in Titanium Sponge. A. R. Gahler and G. Porter. *Analytical Chemistry,* v. 29, Feb. 1957, p. 296-298. (CMA)

Chloride may be quickly and precisely determined in titanium sponge by pyrohydrolyzing the sponge at 1000° C. for 30 min. in quartz or nickel apparatus. The chloride collected in the distillate is determined titrametrically with thiocyanate. The method is applicable to a wide range of chloride. 7 ref. (S11g; Ti)

95-S. The Inspection of Drop Forgings. H. J. Merchant. *The Australasian Engineer,* v. 49, Nov. 7, 1956, p. 47-49, 72.

Primary, processing, final and general inspection. (S general, F22n)

96-S. Radio-Isotopes and Their Use in the Foundry Industry. Dr. S. M. Makin. *Foundry Trade Journal,* v. 102, Jan. 3, 1957, p. 5-10.

Radio-tracer technique, photographic effect, absorption and backscattering of beta and gamma rays. 21 ref. (S13e, E general; 14-13)

97-S. Spot Tests for Copper Alloys. W. Stöckli. *Metal Industry,* v. 90, Jan. 1957, p. 31-32.

Description of electrolytic tests. (S10p; Cu)

98-S. Service Life of Metal Belts in Copper Brazing Furnaces. Fred L. Hooper. *Metal Progress,* v. 71, Feb. 1957, p. 83-85.

Woven wire belts used in copper brazing furnaces last longer if tension is reduced, speed is increased and the belt is reversed periodically. (S21, W12, W29; SS, Ni)

99-S. The Use of Nuclear Techniques in Industrial Testing. Charles Crompton. *Steel Processing,* v. 43, Jan. 1957, p. 38-39, 43.

Radiation gages, radiographic techniques, isotope dilution and other methods are establishing new standards of operation.
(S13e, S14e, 14-13)

100-S. Chemical Determination of Boron in 7% Uranium-Zirconium and 7% Uranium-Zircaloy. J. Rynasiewicz and V. F. Consalvo. *U.S. Atomic Energy Commission, KAPL-M-JR-8,* Aug. 31, 1956, 10 p. (CMA)

An analytical procedure has been developed for boron in Zr-7U and Zircaloy-7U alloys based on the Colorimetric curcumin method. Alloy chips are fused with Na_2CO_3, dissolved in water, filtered, evaporated and leached with ethanol. 8 ref. (S11a; Zr, *U, B*)

101-S. Methods of Separation of Total Rare Earths in Low-Alloy Constructional Steels. A. Westerburg. *U.S. Watertown Arsenal Laboratory. Report 120/73,* Jan. 18, 1957, 24 p. (PB 121337). Abstracted in *U.S. Government Research Reports,* v. 27, Jan. 18, 1957, p. 24. (CMA)

The lanthanon literature is surveyed comprehensively. Bibliographic selections were limited to those references dealing with chemical separation, fractionation, and determination. Studies of the properties of the lanthanons were included when they might suggest a basis for a new or improved analytical scheme. 388 abstracts are given. (S11; AY-n, *EG-g*)

102-S. (French.) **The Index of Acidity of Slags and Its Use in Casting Copper Alloys. Part One.** *Fonderie,* no. 131, Dec. 1956, p. 515-519.

Chemical analysis of slags and flux in the casting process. (To be continued.) (S11, E11; Cu, RM-q)

103-S. (French.) **Rapid Titration of Aluminum in Copper Alloys.** D. A. Detmar, H. C. Van Aller. *Recueil des Travaux Chimiques des Pays-Bas,* v. 75, Nov. 1956, p. 1429-1432.

A practical method of gravimetric titration of aluminum applicable to all copper alloys having an aluminum content of 0.5% or greater. Aluminum is precipitated through 8-hydroxyquinoline into an ammonia solution containing potassium cyanide, tartaric acid and complexone-III. (S11b; Cu, *Al*)

104-S. (French.) **Contribution to the Study of the Analytic Behaviour of Nitrides in Steels.** P. Tyou, J. Vanstiphout and M. Lacombe. *Revue Universelle des Mines, de la Mécanique, de la Métallurgie,* v. 99, Dec. 1956, p. 641-652.

Review of literature. Results of tests on properties of titanium, aluminum and silicon nitrides, with new conclusions on solubility of aluminum nitride in acids. Distribution of hydrogen among different analytic fractions studied in terms of methods of attack. Determination of proportions of metallic elements in classic insoluble fraction N_2 permits hypotheses of nature of insoluble nitrides. Effect of a "solubilizing" treatment on analytic proportions. Thesis that application of this thermal treatment would leave only titanium nitrides insoluble seems to be confirmed. 16 ref. (S11; ST, *N*, 14-18)

105-S. (Japanese.) **Research on the Hydrogen Analysis of Iron and Steel.** Toyosuke Tanoue, Munezo Matsuba and Shunsuke Inoue. *Sumitomo Metals,* v. 8, Oct. 1956, p. 255-260.

Apparatus and method. The extracted hydrogen from a sample is oxidized with copper monoxide and the water vapor produced is absorbed with phosphoric anhydride. (S11r; Fe, ST, *H*)

106-S. (Russian.) **Concerning the Effect of Iron on the Colorimetric Determination of Cerium.** R. K. Korabel'nik. *Zhurnal Analiticheskoy Khimii,* v. 11, July-Aug. 1956, p. 419-422.

The photocolorimetric determination of cerium with ferroin (complex compound of ortho-phenanthrolene with ferrous ions) was investigated. The presence of iron in certain concentrations has an adverse effect on the results of the determination by this method, because cerium-iron complexes are formed. (S11a: Ce, *Fe*)

107-S. (Russian.) **The Oxalate Method for the Detection of Cadmium in the Presence of Copper.** M. P. Babkin. *Zhurnal Analiticheskoy Khimii,* v. 11, July-Aug. 1956, p. 503-504.

A method has been proposed for the detection of cadmium ions in the presence of copper ions, whereby the copper ions are transformed into the complex ions $[Ca(C_2O_4)_2]^2$, while the cadmium is precipitated in the form of the white oxalate $Cd_2O \cdot 3H_2O$, which is then converted into cadmium sulphide. (S11; Cu, *Cd*)

108-S. (Russian.) **Concerning the Problem of the Detection of Cadmium in the Presence of Copper.** A. D. Despiller, M. A. Ourinovich and Y. N. Anisinova. *Zhurnal Analiticheskoy Khimii,* v. 11, July-Aug. 1956, p. 505-507.

In view of the fact that cadmium is also reduced when this metal is separated from copper by reducing copper with zinc, it is proposed that the zinc be replaced with aluminum. The experiments described show that aluminum does not reduce the cadmium. (S11; Cu, *Cd*)

109-S. (Russian.) **Concerning the Detection of Beryllium Ions.** V. K. Zoletukhin. *Zhurnal Analiticheskoy Khimii,* v. 11, July-Aug. 1956, p. 508-509.

A method for the qualitative determination of beryllium ions is proposed which is based on the interaction of beryllium hydroxide with fluorides of alkali metals and the formation of OH ions which bring about reddening of phenolphthalein. (S11; Be)

110-S. (Pamphlet.) **Piping Engineering. 2.02. Pipe Material Specifications.** Oct. 1956. 35 p. Natural Cylinder Gas Co., 840 N. Michigan Ave., Chicago 11, Ill.

API specifications for carbon steel, openhearth and wrought iron; ASTM specifications for carbon steels, carbon-molybdenum steels, chromium-molybdenum steels, stainless steels, low-temperature steels and nonferrous metals. Selection of materials for pipes, boilers and unfired vessels.
(S22; CN, AY, SS, EG-a, 4-10, 15-21)

111-S. (Book.) **The Analysis of Titanium and Its Alloys.** 1956. 84 p. Imperial Chemical Industries, Ltd., London, England. (CMA)

Following discussions of sampling and analytical usages, procedures are given for the determination in titanium of aluminum, calcium, chlorine, chromium, copper, hydro-

gen, iron, magnesium, manganese, moisture, molybdenum, nickel, nitrogen, oxygen and hydrogen, silicon, silver, sodium, tin, tungsten, vanadium, zinc and zirconium. An absorptiometric and a volumetric procedure are recommended for determining titanium. Numerous diagrams of appartus. (S11, 1-2; Ti)

112-S. (Book.) **ASTM Methods for Chemical Analysis of Metals.** 640 p. 1956. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $8.00.

ASTM methods for chemical analysis of ferrous and nonferrous metals and alloys. Complements Part I on Ferrous Metals and Part II on Nonferrous Metals of the *Book of Standards*. It is the first complete revision of the volume since 1950. (S11, S22)

T Metal Products and Parts

42-T. Building the Space Satellites. George H. De Groat. *American Machinist,* v. 101, Jan. 14, 1957, p. 101-106.

Procedure used in constructing the skin and framework of spherical satellite from magnesium. (T24, G general; Mg)

43-T. Russia's Automatic Factory. Peter Trippe. *American Machinist,* v. 101, Jan. 14, 1957, p. 147-154.

Detailed description of completely automated Russian bearing factory with facilities for making 900,000 ball bearings and 600,000 roller bearings a year. (T7d, 18-24)

44-T. Magnesium Swings More Weight in Trucking. G. L. Glaza. *Iron Age,* v. 179, Jan. 17, 1957, p. 78-79.

Truck builders like magnesium because load bearing walls eliminate structural framework and give reduced structural weight and enlarged interior dimensions. (T21; Mg)

45-T. Printing With Magnesium. *Light Metals,* v. 20, Jan. 1957, p. 10-12.

Use of magnesium for photo-engraved printing plates: process, difficulties, advantages. (T9n; Mg)

46-T. The Production of Ball and Roller Bearings. *Machinery,* v. 90, Jan. 4, 1957, p. 4-14.

Bearing-balls and rollers produced are of special high-grade carbon-chromium steel. For large races a low-carbon steel is employed. (T7d, G general; AY, CN)

47-T. Metallurgy in the Nuclear Power Industry. W. E. Dennis. *Metallurgia,* v. 55, Jan. 1957, p. 23-26.

Metallurgical aspects of construction materials. (T11)

48-T. Anaesthetic Equipment. *Metals Industry,* v. 90, Jan. 1957, p. 7-9.

Pressure die castings in anaesthetic equipment. (T10e; 5-11)

49-T. The Protection of Chemical Process Equipment. The Use of Platinum Metals for Bursting Discs. J. M. Pirie. *Platinum Metals Review,* v. 1, No. 1, Jan. 1957, p. 9-13.

Description, requirements and applications are discussed. 3 ref. (T29; Pt)

50-T. (English.) **Steel Structures in the Building of Ironworks and for Mining Purposes in Czechoslovakia.** G. Novotny. *Acier-Stahl-Steel,* v. 21, Dec. 1956, p. 493-498.

Illustrations with explanations. Conclusion is drawn that only steel can meet all requirements for ironwork and mining construction. (T26; ST)

51-T. (English.) **The Highest Structure in the German Federal Republic.** T. Herrnstadt. *Acier-Stahl-Steel,* v. 21, Dec. 1956, p. 499-502.

A detailed description, specifications and illustrations of the steel radio mast constructed between Bremen and Oldenburg, Germany. (T26)

52-T. (English.) **Construction of the Socony Mobil Building, New York.** *Acier-Stahl-Steel,* v. 21, Dec. 1956, p. 503-506.

Description, specifications and illustrations. (T26)

53-T. (English.) **The C.N.E.T. Boiler House at Cachan (France).** F. Vitale and J. Fichot. *Acier-Stahl-Steel,* v. 21, Dec. 1956, p. 507-510.

A detailed description, specifications and illustrations of the boiler house of the C.N.E.T. at Cachan (France), as an example of the use of self-supporting sheet-steel cladding in structures of large span. (T26; ST)

54-T. Metallurgical and Other Factors Associated With the Making of Guthega Penstock. J. E. Power. *Australasian Engineer,* v. 49, Nov. 7, 1956, p. 50-57.

Brief description of methods of penstock fabrication and application; selection and welding of steel plate; radiographic examination of penstock. (T26r, K general, S13e; ST)

55-T. Can Airframes of the Future Be Machined. J. H. Framme. *Automotive Industries,* v. 116, Jan. 1, 1957, p. 68-70, 114-116.

New materials, new processes, forgings. (T24a, G17; SGB-s, 4-1)

56-T. High-Temperature Materials: Metals and Alloys for Aircraft-Engine Construction. H. E. Gresham. *Engineering,* v. 182, Dec. 28, 1956, p. 818-820.

Poppet valve developments, precipitation hardening, steels for turbine disks, materials for gas-turbine blades and for nozzle guide vanes, and light alloys for high temperatures. (T24b; SGA-h)

57-T. Special Materials for Unusual Ball Bearing Applications. William Blinder. *General Motors Engineering, Journal,* v. 4, No. 1, Jan.-Feb.-Mar. 1957, p. 42-46.

Testing program to evaluate various bearing materials, and to help the designer in solving the problems created by the newer and more stringent requirements. (T7d, 17-1)

58-T. Aluminum for Marine Switchgear. H. F. Harvey and E. J. Dawson. *Marine Engineer,* v. 79, Dec. 1956, p. 482.

Annual review of the development of marine switchgear. (T22h, W11, 17-7; Al)

59-T. For Electrical and Chemical Equipment Try Fine Silver. Edward E. Tietz. *Materials & Methods,* v. 45, Jan. 1957, p. 110-111.

Description of grades, properties, fabrication and applications. (T29, Ti; Ag)

60-T. New Uses of Magnesium. *Materials & Methods,* v. 45, Jan. 1957, p. 112-114.

Report on some recent uses, including dictating, recording, military electronics equipment, high speed teleprinters. (T general, 17-7; Mg)

61-T. Thorium's Role in Atomic Power. John P. Howe. *Metal Progress,* v. 71, Feb. 1957, p. 97-103.

Nuclear reactions involving thorium, the reactor types which use the material, function of the thorium in these reactors, manufacture and reprocessing of thorium-base reactor components, and some of the economic factors. (T11, W11, 17-7; Th)

62-T. Non-Nuclear Uses of Thorium. W. C. Lilliendahl. *Metal Progress,* v. 71, Feb. 1957, p. 104-107.

Principal use of thorium metal in industry is very recent—for alloying with magnesium. Nearly all of the other uses are in the lighting and electronics industry, mostly as oxide. The oxide also has interesting possibilities as a refractory for very high temperature. (T1, W29, 17-7; RM-h, AD-n, Th)

63-T. Are Castings Meeting Detroit Demands? M. F. Garwood. *Modern Castings,* v. 31, Feb. 1957, p. 36-38.

Gray iron, malleable iron, ductile iron and light metals for automobile industry. (T21; CI, EG-a39, 5)

64-T. Fabricating and Testing Tubular Fuel Elements. Samuel Storchheim. *Nucleonics,* v. 15, Jan. 1957, p. 85-91.

Dispersion of uranium oxide, forming a tube, cladding, cold-pressure welding, temperature effect, time effect and nondestructive testing. 6 ref. (T11g, U)

65-T. Aluminum-Tin Bearings Show Little Wear After 60,000 Miles. *Scientific Lubrications,* v. 8, Dec. 1956, p. 31-33.

Chemical composition and wear according to distance traveled. (T7d, Q9n; Al, *Sn*)

66-T. A Survey of the Techniques and Equipment Used in the Production of Coins. Gilbert H. Thompson. *Sheet Metal Industries,* v. 14, Jan. 1957, p. 17-24; disc., p. 40.

Description and operation of various coining presses, equipment for inspection and counting, die making. Conclusion. (T9b, G1)

67-T. New Uses for Stainless Steels. Howard Biers. *Sheet Metal Industries,* v. 14, Jan. 1957, p. 25-34.

Current and future uses in aircraft, automotive, marine, atomic energy, architectural, domestic and steam-raising fields. (T general, 17-7; SS)

68-T. DC-8 Production Helped by Cutter Fabrication at Douglas. N. P. Cici. *Western Machinery and Steel World,* v. 48, Jan. 1957, p. 68-72.

Description of fabrication. Cutters include two-blade, four-blade, open and closed helix angle combinations, staggered tooth, forward and reverse direction of rotation, two and three-part assemblies, special end mills, shell mills and inserted blade cutters for a variety of materials. (T6n)

69-T. Steel Is in the Wild Blue Yonder. Rulon Nagely. *Western Machinery and Steel World,* v. 48, Jan. 1957, p. 96-97.

Trends and recommendations for material requirements for aircraft and missiles of the future. (T24, T2; ST)

70-T. Forged Steel Crankshafts. Harold F. Wood. *Society of Automotive Engineers, Preprint,* Jan. 1957, 10 p.

Rolling and forging processes, metallurgical quality control, heat treatment, centering and dynamic balance control, mechanical properties, modulus of elasticity and endurance limit in crankshaft design. (T21f; ST, 4-1)

71-T. (English.) **The Use of Stainless Steel in Curtain Wall Construction.** *Engenharia, Mineracao e Metalurgia,* v. 24, Sept. 1956, p. 127-131.

Structural and decorative advantages, types of stainless recommended for architectural use; waviness of large flat surfaces and methods of overcoming; factors to be considered

in attaching stainless curtain to building framework; insulation. (T26; SS)

72-T. (French.) **Thorium and Fissile Elements.** R. Gibrat. *Énergie Nucléaire,* v. 76, Oct. 1956, p. 25-31.

Comparison of properties of the three known nuclear "fuels": U^{235}, U^{233}, Pu^{239}. Review of principal problems encountered in designing plant for chemical treatment of irradiated thorium in light of separation of uranium-233 produced. (T11g, C28; U, Pu, Th)

73-T. (French.) **Stainless Steel in the Food Industries.** Paul Chave. *Industries Alimentaires et Agricoles,* no. 12, Dec. 1956, p. 869-870.

Advantages derived from the use of 18-8 stainless steel of low carbon in the storage and transportation of foodstuffs such as milk, tomatoes, fruit juices and vegetables. (T29; SS)

74-T. (German.) **Roller Bearing Steel Stock and Its Importance in the Manufacture of High-Quality Roller Bearings.** A. Naumann. *Die Technik,* v. 11, Nov. 1956, p. 767-772.

A comparison of East German and United States standards for roller bearing stock, as well as the various chacteristics of importance to its manufacture. 6 ref. (T7d; ST, 15-6)

75-T. (Russian.) **Tantalum and Columbium in the Chemical Industry.** G. V. Samsonov and V. I. Konstantinov. *Khimicheskaya Nauka i Promyshlennost,* v. 1, Sept.-Oct. 1956, p. 517-522.

Applications of columbium and tantalum. (T29; Cb, Ta)

W Plant Equipment

41-W. Electrical Equipment for Steel Mill Drives. E. H. Browning. *Blast Furnace and Steel Plant,* v. 45, Jan. 1957, p. 67-71.

Arrangement of d.c. drive motors with magnetic amplifier controls for rod mill, continuous annealing line, and electrolytic tinning line. (W22)

42-W. Position Control of Electrical Screwdown Drives. D. B. Manwaring. *Blast Furnace and Steel Plant,* v. 45, Jan. 1957, p. 72-77.

Reviews limit switch method, potential divider method and synchro method of screwdown controls for rolling mills. 31 ref. (W22)

43-W. Electric Rolling Mill Drives. Jan Soukenik. *Czechoslovak Heavy Industry,* no. 8, 1956, p. 3-15.

History and production program of the Skoda Works electrical engineering factory. Electric motor drives for open rolling mills and continuous rolling mills described. (W23)

44-W. Conveyor Speeds Inspection at New Permanent Mold Foundry. James Joseph. *Foundry,* v. 85, Feb. 1957, p. 146-148.

Conveyor system permits continuous and immediate inspection of aluminum castings. (W12, E12; Al, 5)

45-W. Skin Miller Contours Slabs Automatically. *Iron Age,* v. 179, Jan. 10, 1957, p. 63.

Automatic continuously operating machine with tracer cams makes 120 nonparallel cuts in 5 x 20-ft. aluminum slabs. (W25, G17b; Al, 4-2)

46-W. Rectifiers Bid for More Metalworking Jobs. Arthur Johnson. *Iron Age,* v. 179, Jan. 10, 1957, p. 70-71.

New types of germanium and selenium rectifiers offer compactness, safety, efficiency and flexibility for power units used in steelmaking, arc welding and electroplating. (W11, 17-7; Ge, Se)

47-W. Where Computers Fit in Metalworking. J. J. Obrzut. *Iron Age,* v. 179, Jan. 17, 1957, p. 71-74.

Wide and varied uses for fast accurate calculations in engineering programming, material control and other branches of metalworking. (W14)

48-W. How Plastics Curb Corrosion in Metal Processing. J. H. Lux. *Iron Age,* v. 179, Jan. 17, 1957, p. 80-82.

A number of different plastics have been developed and successfully used for pickling tanks, plating baths, distillation columns, fume ducts, exhaust stacks and numerous other corrosion resistant services. (W general, R general; NM-d)

49-W. Construction and Application of Draft Recorder on a 44-in. Blooming Mill. N. S. Wells, J. Sibakin. *Iron and Steel Engineer,* v. 34, Jan. 1957, p. 103-112.

Design and installation of draft recorder on mills; improvement and standardization of draft practice. (W22; ST)

50-W. Reducing Delays in Blast Furnace Campaigns by Improving Mechanical Features. W. O. Bishop, Charles P. Frame. *Iron and Steel Engineer,* v. 34, Jan. 1957, p. 113-117.

Mechanical and engineering features for improving the life of furnace campaigns. (W17, 17-1)

51-W. High-Strength Turbine Alloy. *Metal Industry,* v. 90, Jan. 1957, p. 3-5.

Studies and requirements in the preparation of a high-strength alloy with high material damping. (W11, 17-7; SGB-a)

52-W. Handling and Packing Forum on Technical Progress. *Steel,* v. 140, Jan. 7, 1957, p. 396-406.

Twenty-four executives briefly comment on recent developments. A few of these are: improvements in steel strapping, new trucks with greater maneuverability, higher lifting speed and work load. Trends toward greater mechanization and automation. (W12, 18-24)

53-W. Kaiser's New Cranes Are Aluminum. *Steel,* v. 140, Jan. 14, 1957, p. 88-89.

Development of new light-weight cranes made possible by easily weldable new aluminum alloy. (W12, 17-7; Al)

54-W. Motor Body Production at Briggs. *Welding and Metal Fabrication,* v. 25, Jan. 1957, p. 9-16.

Mechanical transfer equipment used by car body manufacturer and welding procedure for fenders, side door and under-body assemblies. (W12, K general, T21a)

55-W. New Power Sources for Metal-Arc Gas-Shielded Welding. A. U. Welch. *Welding Journal,* v. 36, Jan. 1957, p. 36-40.

Direct-current rectifier-type welders designed specifically for gas-shielded consumable-electrode arc welding and high current density submerged-arc welding. (W29, K1d)

56-W. Tape Controlled Riveting Machine Increases Production 400 Per Cent. *Western Machinery and Steel World,* v. 48, Jan. 1957, p. 73.

Produces fuel-sealed wing segments automatically. (W1, K13n)

57-W. (German.) **The Manufacture of Graphite Electrodes for Electric Steel Furnaces.** Alfred Ragoss. *Archiv für das Eisenhüttenwesen,* v. 27, Nov. 1956, p. 681-688.

Molten carbon possible only at very high temperatures under high pressure; manufacture of graphite electrodes from granulated carbon with binder. For high conductivity use of petroleum and pitch cokes necessary. Description of procedures. 10 ref. (W18; NM-K36)

58-W. (German.) **Galvanizing Furnaces With Forced Waste Gas Rotation Heating. (Part 2.)** J. Kohlgrueber. *Draht,* v. 7, December 1956, p. 468-472.

Illustrations and detailed descriptions are given of an iron wire galvanizing installation, a thin plate-galvanizing installation, and a galvanizing furnace with oil-waste gas rotation heating. (W3, L16; ST, *Zn*)

59-W. (German.) **Bell-Type Furnaces for Annealing Sheets in an Upright Position in a Protective Gas Atmosphere.** Ernst Labouvie. *Stahl und Eisen,* v. 76, Dec. 27, 1956, p. 1741-1744.

Preliminary tests for a new type of annealing furnace. Design of the furnace for annealing in a vertical position. Test results. Behavior of the sheets in their further processing. (W27, J23; 4-3)

60-W. Nickel-Chromium Alloy Extends Life of Salt Pot. *Automotive Industries,* v. 116, Jan. 1, 1957, p. 67.

Inconel pot users report long service life. (W28, 17-7; Ni, *Cr,* SGA-h)

61-W. Metal Rectifiers for Electroplating. D. J. Fishlock. *The Electrical Journal,* v. 158, Jan. 4, 1957, p. 26-29.

Selenium rectifiers; transformers, constant current density controllers, anodizing controllers, power supplies and water-cooling equipment for rectifiers. 2 ref. (To be continued.) (W3)

62-W. Gas and the Non-Ferrous Metal Industry. G. le B. Diamond. *Metal Industry,* v. 90, Jan. 1957, p. 43-45.

Recent furnace conversions to gas as a solution to fuel problem in England, including installations for brass melting, aluminum alloy melting, stereotype metal melting and associated equipment. (W18, RM-m, Cu-n, Al)

63-W. Metal Polishing With Set-Up Wheels. R. S. Burt. *Metal Finishing,* v. 55, Feb. 1957, p. 52-55.

Types of adhesives, abrasion materials, preparation of wheel for set-up and paste heading of polishing wheels. (W2, L10b; NM-j)

64-W. (Dutch.) **Foundry Melting Furnaces for Nonferrous Metals. (Part I.)** H. Boswinkel. *Metalen,* v. 12, Jan. 1957, p. 2-6.

A review of various types of furnaces and of criteria for selection to meet practical requirements. (To be continued.) (W19; EG-a)

65-W. (French.) **Refractory Lining of Crucible Furnaces.** *Fonderie,* no. 131, Dec. 1956, p. 513-515.

Suggests that ordinary siliceous linings for crucible furnaces, and silicon carbide where very high temperatures are required, are preferable to the use of silicon-aluminum bricks. (W19; RM-h 36)

66-W. (French.) **Descriptive Sketch of a Rotary Hearth Furnace for the Heat Treatment of Plough Moldboards.** *Metallurgie et la Construction Mecanique,* Dec. 1956, p. 1037-1038.

Stresses the superiority of the rotary hearth furnace in the manu-

(*Continued on p. 69*)

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, O., unless otherwise stated.

POSITIONS OPEN

West

METALLURGICAL ENGINEERING TEACHERS: At San Francisco Bay Area College. Expanding program; $4-million building addition now being planned; excellent part-time industrial and graduate work opportunities; excellent salary scale. Write to: Head, Engineering Dept., San Jose State College, San Jose 14, Calif.

Midwest

METALLURGLIST: A medium-size corporation in suburban Chicago has a "once in a lifetime" opportunity for a young metallurgist familiar with aluminum extrusions. Required to take over entire metallurgical program including spectrographic laboratory set-up and operation, physical laboratory set-up and operation, furnace surveys, pyrometry and trouble shooting, metallography, metallurgical report writing, and manufacturing process writeups. Must be able to get along well with fellow workers and should be able to handle pepole. Advancement unlimited, salary commensurate with experience. Give all particulars in your letter. Box 3-5.

QUALITY CONTROL ENGINEER: Young man with background in metallurgy and statistics for opening in newly created quality control program. Manufacturing processes include die casting, metal stampings and electroplating. Send resume to: Personnel Dept., Brown-Lipe-Chapin Division, General Motors Corp., Syracuse, N. Y.

MATERIALS DEVELOPMENT ENGINEER: Metallurgical graduate, age 23 to 30, with experience in aluminum alloys, to work on challenging development projects. Excellent opportunity to round out experience by taking projects from the laboratory through pilot plant stage and into final production. Will work not only with development group but also with engineering, product design and production personnel. Multiplant company with good growth potential located in northeastern Ohio. Box 3-10.

SENIOR MATERIALS DEVELOPMENT ENGINEER: Metallurgical graduate, 32 to 50 years old, with considerable experience in powder metallurgy, to direct laboratory phases of powdered metallurgical projects. Work involves direction of development from the laboratory through pilot plant and customer sample stage into production. Work includes not only laboratory phase but also specifying production processes and equipment, training production personnel, and writing process and material specifications. Location Northern Ohio. Box 3-15.

RESEARCH ASSISTANT: Opportunity for part-time employment while studying for advanced degree in metallurgy. Courses and research facilities are available for kinetics, mechanical metallurgy, physical metallurgy, physics of solids, thermodynamics and X-ray diffraction. Applications with undergraduate degrees in science or engineering will be considered. Write to: Dept. of Metallurgy, The Technological Institute, Northwestern University, Evanston, Ill.

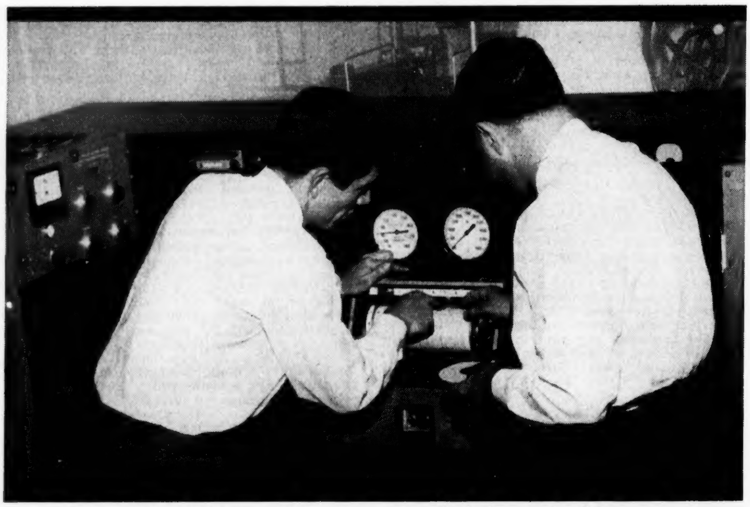
METALLURGIST: B.S. degree in metallurgy, or in engineering field which includes metallurgy. Three to five years experience in industry, either producing or consuming. To work in field of plant metallurgy. control of operations and contact with customers to develop metallurgical process in accordance with latest ideas. Box 3-20.

ASSISTANT IN WELDING ENGINEERING: Half-time employment, open to any person holding B.S. degree in welding, electrical, metallurgical, general, civil or chemical engineering, or physics, with strong interest in teaching and research. Knowledge of welding field desirable but not essential. Candidate should be interested in pursuing advanced degree in welding engineering. Acceptance by The Ohio State University Graduate School is also a condition of employment. Will spend approximately 20 hr. a week in teaching and research activities. Salary is $1800 for nine months; out-of-state fees will be remitted. Interested person should forward complete resume of educational and industrial experiences to: The Chairman, Dept. of Welding Engineering, Room 128, Industrial Engineering Bldg., Ohio State University, Columbus 10, Ohio.

METALLURGISTS: For manufacturer of aircraft missile and nuclear control components, to work on evaluation and material specification of high-temperature alloys for turbines, nozzles and combustion chamber applications. Wrought and cast light alloys, bearing materials, and structural materials for highly stressed components in pumps, power transmission units, etc. Must be familiar with various ferrous and nonferrous heat treating procedures and equipment, as well as brazing and welding techniques. Box 3-25.

OPPORTUNITIES FOR

Metallurgists, Ceramic Engineers
Welding Engineers
Materials Test Engineers



An example of Marquardt's progress and challenge is this new test instrument—designed and built by Marquardt Aircraft Co. engineers. The only one in existence, it was created to provide information on short time elevated temperature properties of materials utilized in supersonic missiles and powerplants.

Engineers are needed to conduct development programs aimed at establishing design and manufacturing criteria for the application of metals to ramjet engines. These programs cover a wide variety of structural materials and many different manufacturing processes.

Included are such diversified programs as:

1 The evaluation of new alloys from aluminum to molybdenum.

2 The development and evaluation of new manufacturing techniques from welding and forming to the application of ceramic coatings and high temperature brazing.

3 Investigations of the physical and mechanical properties of materials at temperatures from −350°F to +3000°F for service lives ranging from seconds to hours.

4 Support of the design and fabrication of experimental ramjet engines.

Requirements exist for personnel at all levels of training and experience. Bachelors—or advanced degrees in engineering are required.

Now is the time to write *that* letter, or call
John Murray, Professional Personnel
16555 Saticoy • Van Nuys, Calif. • STate 5-8361

marquardt AIRCRAFT CO.

FIRST IN RAMJETS

Van Nuys, California • Ogden, Utah

East

METALLURGIST: For brass mill manufacturing phosphor-bronze, nickel-silver and brass in the form of strip, wire and rod. Excellent position offering advancement and many benefits. Write to: The Riverside Metal Co., Division of H. K. Porter Co., Inc., Riverside, N. J.

Naval Air Materiel Center engaged in extensive program of aeronautical research, development, experimentation and test operations for the advancement of naval aviation needs metallurgists (salaries $5335 to $7035 per annum) for work on high strength steels, precision castings, heat resisting alloys, oxidation resistant coating for molybdenum, inert and shielded-metal arc and resistance welding. Positions include research, development and evaluation-type duties. File Application for Federal Employment, Standard Form 57, with Industrial Relations Dept., Naval Air Materiel Center, Naval Base, Philadelphia 12, Pa. Applications may be obtained from the above address or from any first or second class post office.

METALLURGISTS: Advanced degree of B.S. with five years experience, for development and research work on a variety of problems related to high-temperature alloys. Unexcelled opportunity for growth in a rapidly expanding company, with earnings and fringe benefits equal to highest in industry. Moving expenses paid. All replies confidential. Located in Upstate New York. Send resume and salary requirements. Box 3-30.

PROCESS METALLURGIST: Graduate metallurgical engineer with minimum of five years experience in heat treating, brazing, soldering and welding or wrought and cast ferrous and nonferrous materials. Exceptional opportunity with an expanding organization for man with experience to evaluate and control manufacturing processes and act as consultant to design engineers in the application of these processes. Standards and specifications experience desirable. Excellent company benefits. Send complete resume, including salary requirements. Box 3-25.

LIGHT ALLOYS METALLURGIST: Excellent opportunity for graduate metallurgist with minimum of five years experience in application and fabrication of aluminum and magnesium alloys. Position is with a progressive engineering and manufacturing organization offering exceptional benefits. Duties to include consultation with design engineers and manufacturing personnel, development of standards and specifications, etc. Send complete resume, including salary requirements. Box 3-40.

METALLURGIST: Young engineer as assistant to chief metallurgist of leading manufacturer of cutting tools and gages. Multiplant international organization of 2000. Well-equipped laboratory for investigational work. Must have capacity for growth in organization. Ideal Berkshire foothills location for pleasant living. Write to: Personnel Division, Greenfield Tap and Die Corp., Greenfield, Mass.

SALES: Toolsteel sales engineer in Metropolitan New York area. Applicant must have practical knowledge of toolsteels and their applications. Some sales experience desirable. Please submit complete resume. Box 3-45.

TECHNICAL DIRECTOR: $12,900 annually, to coordinate and direct departments of mechanical engineering, applied physics, metallurgy and chemistry. Mission is to conduct applied research and development, evaluate fleet failures, and test engineering equipment and materials in the marine engineering field. Applicants should have one or more degrees in engineering and at least three years of broad professional experience of a very high order. Advanced degree(s) are highly desirable. Forward inquiries or applications to the Industrial Relations Officer, U.S. Naval Engineering Experiment Station, Annapolis, Md.

A.S.M. TRANSACTIONS

Back volumes and sets wanted for cash. Also other scientific and technical journals.

M. R. Ashley, 27 E. 21st St., New York 10, N. Y.

WANTED
HEAT TREATING FURNACE DESIGNER

Top starting salary with unlimited opportunity in a responsible position. Generous insurance and pension benefits. Interviews arranged at our expense.

Write or phone collect:
A. W. Frank
HEVI-DUTY ELECTRIC COMPANY
P. O. Box 563
Milwaukee 1, Wisconsin

(*continued from p.* 66)
facture of plough moldboards. Describes structure and operation of furnace. (W27)

67-W. (German.) **Assessment of Various Furnace Linings.** Edgar Spetzler. *Stahl und Eisen,* v. 76, Dec. 27, 1956, p. 1734-1740.

Consumption of chrome ore-magnesite bricks in openhearth steel plants. Grouping of furnace linings by types of bricks. Comparative assessment of various brick linings. Cost of brick for furnace repairs. Oxygen requirements dependent on type of lining. Efficiency of the furnace. Furnace output and heat consumption. Metallurgical work and conditions of operation. 2 ref. (W18, D2g; RM-h)

X Instrumentation

Laboratory and Control Equipment

20-X. Monitor for Peak Combustion Efficiency Measures O_2 Content in Flue Gases. *Blast Furnace and Steel Plant,* v. 45, Jan. 1957, p. 86-88.

Magnetic type O_2 analyzer with probe units, electric recorder controller offers combustion control for plant boilers or steel openhearths. (X21, W18; RM-g34)

21-X. Laboratory Production of Cylindrical Alumina Crucibles of 5½ Litres Capacity. Vaughan H. Stott. *Journal of the Iron and Steel Institute,* v. 185, Jan. 1957, p. 82-85.

Details for forming the crucibles and a convenient gas furnace for firing them. (X general, B19)

22-X. TV Camera Aids Spotweld Control on Airframe Skin. Don Post. *Western Metals,* v. 15, Jan. 1957, p. 72.

TV allows spotwelder to follow quality of welds on underside of aluminum panel. (X5, K3n; Al)

23-X. Thermodynamic Analysis VII. The Dry Ice Calorimeter. Willy Oelsen, Wilhelm Tebbe and Olaf Oelsen. *Archiv für das Eisenhüttenwesen,* v. 27, Nov. 1956, p. 689-694.

Large volume change during sublimation of dry ice used to measure enthalpies. Simple and improved apparatus described. Calorimeters used to measure heat contents of metals and alloys. 14 ref. (X24, p12r)

24-X. A New Electrolytic Cell for Isolating Carbides and Nonmetallic Inclusions in Steel. N. Backstrom, Sakari Heiskanen and Urpo Ime. *Engineers Digest,* v. 17, Dec. 1956, p. 523-524. (From *Jernkontorets Annaler,* v. 140, no. 10, 1956, p. 812-816.)

Previously abstracted from original. See item 6-X, 1957. (X4; ST, NM-a 35, 9-19)

25-X Heavy Presses: Strain Gages Stand Guard. Leon Mollick and James Jursik. *Steel,* v. 140, Jan. 28, 1957, p. 92-93.

Self compensating hydraulic system and strain gage control system protect forging presses against dangerously large eccentric moment. (X28, W24)

WESTERN METAL CONGRESS

WESTERN METAL EXPOSITION

Pan-Pacific Auditorium

Los Angeles

Mar. 25-29, 1957

HERE'S HOW . . .

To get copies of articles annotated in the A.S.M. Review of Current Metal Literature

Two alternative methods are:

1. Write to the original source of the article asking for tear sheets, a reprint or a copy of the issue in which it appeared. A list of addresses of the periodicals annotated is available on request.

2. Order photostatic copies from the New York Public Library, New York City, from the Carnegie Library of Pittsburgh, 4400 Forbes St., Pittsburgh 13, Pa., or from the Engineering Societies Library, 29 West 39th St., New York 18, N. Y. A nominal charge is made, varying with the length of the article and page size of the periodical.

Write to Metals Review for free copy of the address list

METALS REVIEW

7301 Euclid Avenue Cleveland 3, Ohio

POSITIONS WANTED

GRADUATE METALLURGICAL ENGINEER: Age 28, married, two children, ten years ferrous experience in heat treatment, metallography, physical testing, writing and supervision. Would like permanent, career position in Detroit area, prefers smaller organization, enjoys sales and personal contact work. Box 3-50.

PLANT MANAGER: Age 39, graduate metallurgical engineer. Experienced in all phases of manufacturing, including mass production and job shop work. Ferrous, nonferrous, stainless steels, titanium. Heavy costs and accounting background. Desires to locate as plant manager or top quality control position. Salary in five figures. Box 3-55.

METALLURGICAL ENGINEER: B.S., M.S. degrees. Supervisor of development group. Background in melting techniques, solidification phenomena, high-vacuum equipment. Has designed, installed and operated large vacuum-induction and vacuum-arc equipment, supervised group in development of pilot plant processes for manufacture of fuel elements. Several published articles. Wants responsible position in aggressive firm working with reactive metals. Box 3-60.

EXTRUSION METALLURGIST — PROCESS DEVELOPMENT ENGINEER: With 15 years experience in light metal extrusion field covering production, metallurgical and process development, sales and administration. Completely familiar with all phases of die design, extrusion, finishing operations and product requirements. Desires sales engineering, production or technical staff position. Box 3-65.

METALLURGIST: Ph.D. degree, age 33, family. Broad research experience and interests in extractive and physical metallurgy, titanium technology, stainless and high-temperature alloys, cermets, service failure analyses. Adept at research planning, supervision and writing. Desires responsible position in Metropolitan New York-New Jersey area. Box 3-70.

MANAGEMENT — METALLURGIST: Plant superintendent, experienced in plant management, sales management production metallurgy. Top administrator and organizer with a record of creative achievement in metal fabrication, air conditioning and transportation industries. Experienced in production, development and cost reduction. Desires position leading to top management in related metals field. Age 34. Box 3-75.

METALLURGIST: Age 37, M.E. in metallurgy, family, veteran. Eleven years diversified experience in steel foundry, specialty steel mill, industrial research institution. Broad knowledge of mechanical properties, metallography, heat treatment and steelmaking processes associated with production and application of tool and alloy, stainless, high-temperature and specialty steels. Minimum salary $10,000. Location unimportant. Box 3-80.

METALLURGICAL ENGINEER: B.S. and M.S. degrees, age 45, married, family. Twenty years varied experience, last 10 years teaching in large engineering college, and research. Experienced in metallography, mechanical testing, X-ray and X-ray diffraction and creep. Publications on zirconium alloys. Desires position in development or research. West Coast preferred but will consider other locations. Box 3-85.

METALLURGIST: B.S. degree, age 30, married, veteran. Five years industrial experience in various phases of fabrication, processing and development of aircraft and commercial aluminum alloys. Desires position in development, process or materials engineering with company finishing aluminum alloy products. Prefers East. Box 3-90.

METALLURGICAL ENGINEER: Age 39, married, family, metallurgical engineering degree. Some advance studies. Experience in research and development. Desires position in research, development, or trouble-shooting. Resume upon request. Box 3-95.

MECHANICAL ENGINEER: Twenty years experience in manufacture of power boilers (15 years as supervisor), now head of the forge division. Forgings and pressure pipe forming. Two years experience in labor relations. Proven executive and technical ability. Wants executive or supervisory position in manufacturing. Salary open for discussion. Box 3-100.

PHYSICAL METALLURGIST: Ph.D. degree, long diversified experience. Can use laboratory facilities. Willing to do consulting work, research, literature surveys, translation (French to English), etc. Box 3-105.

METALLURGIST: B.S. degree with 25 years industrial experience in both production and utilization of metals. Employed at management level but desire more responsible position with promising future. Specialized in development, application and trouble shooting; would consider customer contact and sales. Box 3-110.

ENGINEER: Mechanical and metallurgical, more than 20 years in all phases of metals fabrication including impact extrusion of ferrous and nonferrous metals, heat treating, layout, materials handling, methods, tooling, customer contact. Box 3-115.

METALLURGICAL ENGINEER: Degree, age 31, married, family. Six years casting experience in production of wrought aluminum alloys, coppers, copper-base alloys and white metals. Seeks work in related fields. Presently employed but desires job with more future. Box 3-120.

METALLURGICAL CHEMIST: Long experience in ferrous and nonferrous metal analysis. Has well-equipped laboratory. Would like to do analysis for plants in New Jersey area. Box 3-125.

POWDER METALLURGIST: Over 20 years experience in ferrous and nonferrous. Graduate metallurgical engineer. Experience in production of metallic powders to production of finish parts. Research and development on titanium and stainless steel porous sheets, vacuum sintering, refractory materials, cermets and magnetic materials. Would consider sales. Box 3-130.

EXECUTIVE ENGINEER: Age 41. Moving to Los Angeles. Heavy background in metal industry covering manufacturing methods, estimating, engineering, design, research and plant layout. Wide experience in fabrication and welding of carbon and alloy steels, stainless, Monel and aluminum, using manual and automatic equipment. Detailed knowledge of pressure vessels, heavy machinery, chemical equipment and railway and highway bridges. Registered professional metallurgical engineer, Ohio and New York. Box 3-135.

METALLURGICAL ENGINEER: Ph.D. degree, married, family, veteran, age 39. Experience in teaching, academic and industrial research. Co-author several technical papers. Desires position in teaching, research, or administration within academic institution. Box 3-140.

METALLURGICAL ENGINEER: B.S. degree, married. Experience in research, sales, magnesium sand casting sales and as engineer on American advisory staff for plants located in Europe. Desires sales in light metals or welding products, or as metallurgical engineer in light metals industry. Box 3-145.

METALLURGICAL ENGINEER: M.S. in metallurgical engineering. Research in the extractive metallurgy of metals for nuclear energy applications including electrolytic methods. Some fundamental studies of metals by means of a novel X-ray diffraction technique. Desires position in research. Particulars on request. Box 3-165.

METALLURGICAL ENGINEER: B.S. degree, age 41, married. Fifteen years experience in development and control of materials and processes. Material failure analysis, metallurgical consultation on design, and manufacturing problems. Headed metallurgical department and chemistry laboratory. Desires position as metallurgical consultant or metallurgical or development department head. Resume upon request. Will consider relocating. Box 3-170.

METALLURGIST

Magnesium or aluminum experience in sand castings desirable. Principally production problems consisting of improving procedure on established jobs and rigging of new work. Some development and research.

WELLMAN BRONZE & ALUMINUM CO.
2525 East 93rd St.
Cleveland 4, Ohio

TITANIUM METALS CORP. OF AMERICA

First in Titanium

Metallurgical Engineering openings created by announced plans for expansion of sponge and ingot production facilities:

RESEARCH METALLURGISTS

Excellent opportunities in research and development of new titanium alloys, processing procedures, and heat treatment, for men with 0-5 years experience and B.S. or M.S. in Metallurgical Engineering.

RESEARCH METALLOGRAPHER

Opening immediately available for qualified Metallurgical Engineer capable of supervising research metallographic laboratory, developing metallographic procedures, and performing project engineering duties on alloy development and heat treating programs. 1-5 years experience and B.S. or M.S. in Metallurgical Engineering.

Salaries for these positions in our Technical Department will be commensurate with education, experience, and ability.

Please send resumes to:

Industrial Relations Department
Titanium Metals Corp. of America
P.O. Box 2128
Henderson, Nevada

METALLURGISTS

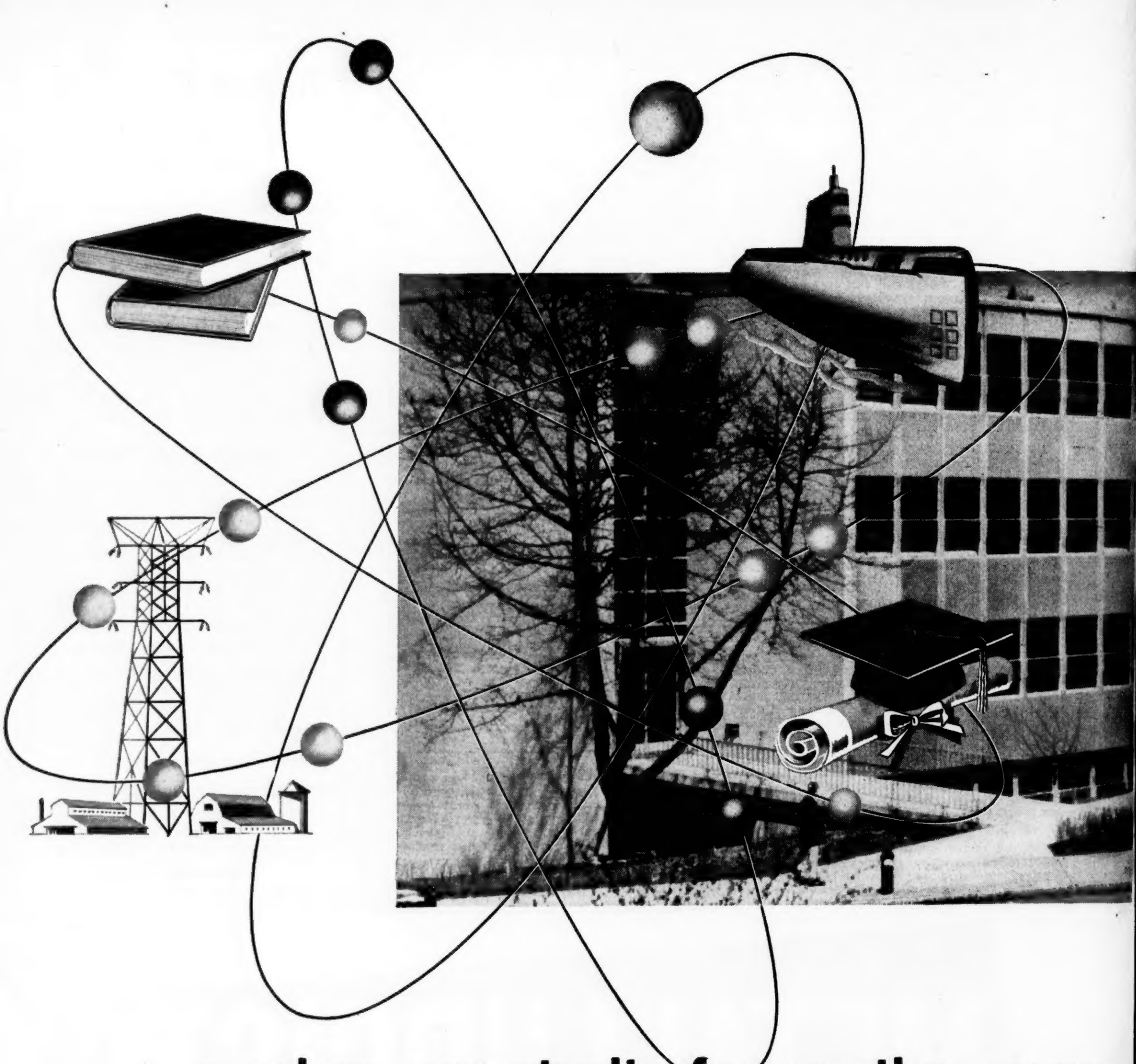
- **LONG ESTABLISHED COMPANY**
- **OPPORTUNITY FOR INDIVIDUAL GROWTH**
- **LIBERAL BENEFITS**

Design and fabrication of fuel elements for naval nuclear power

A NEW DIVISION OF A PIONEER IN THE MANUFACTURE OF STEAM GENERATING EQUIPMENT

Submit Resume to
Keith D. Martin

C-E COMBUSTION ENGINEERING
REACTOR DEVELOPMENT DIVISION, WINDSOR, CONN.



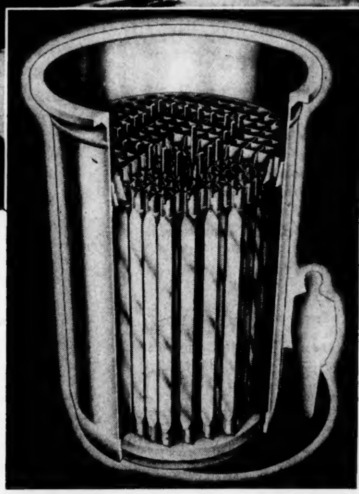
a unique opportunity for creative young

To meet the growing need for trained scientists in nuclear power, the Carnegie Institute of Technology and the Westinghouse Electric Corporation in cooperation with the Atomic Energy Commission have developed an educational program that permits carefully selected graduates with bachelor or master degrees to earn Doctor of Philosophy degrees in the field of metallurgical engineering.

This unique opportunity allows those chosen to receive a regular salary while pursuing a shortened work week and an eight hour or longer academic week. This schedule will normally enable each candidate to complete the doctorate course work within a four year period, as well as attend campus seminars and coloquia. During the summer school sessions he will begin preliminary investigation and research on his thesis topic. An unusual aspect of the program provides that during the course of the fellowship, the doctoral candidate will have a year of educational leave with a realistic living allowance, based upon the size of his family, to complete his doctoral thesis research requirements. The fellowship is designed under normal circumstances to allow the student to complete the rigorous doctoral requirements of the Carnegie Institute of Technology in a five to six year period.

While working at Bettis Plant, operated for the Atomic Energy Commission by Westinghouse, he will be associated with the scientists and engineers who pioneered in the field of atomic power with the first practical application of a nuclear power plant for the USS *Nautilus*. Other projects on which the young metallurgist may work include the atomic power station at Shippingport, Pennsylvania, the first full scale commercial generating facility to be built in this country; or the design and development of nuclear reactors for additional submarines and various types of surface ships.

Donor Hall, Carnegie Institute of Technology Campus



The reactor core for the Shippingport Atomic Power Station

metallurgical engineers

In addition to these projects, Westinghouse metallurgists are conducting basic research in areas such as solid phase transformation, corrosion kinetics and mechanisms and the effects of irradiation on metals. At the Carnegie Institute of Technology, the fellowship recipient will develop an individual course of study to complete his doctoral program which may or may not be related to his area of work interest. Furthermore, he will be eligible for salary increases and professional advancement just as if he were working full time.

If you are under twenty-seven years of age, deducting time spent in military service, and have a Bachelor of Science or Master of Science degree with an outstanding academic record, and if you are a U.S. citizen interested in advanced study, write today for a descriptive brochure which outlines the details of the program. Write to Mr. M. J. Downey, Dept. A-136, Westinghouse Bettis Plant, P.O. Box 1468, Pittsburgh 30, Pa.

BETTIS PLANT

Westinghouse

P.O. BOX 1468, PITTSBURGH 30, PENNSYLVANIA

March 25 through 29, 1957

SUBJECTS TREATED BY TOP AUTHORITIES

From comprehensive lectures and discussions on the latest known techniques, you can gain a wealth of practical knowledge that is so greatly needed today. The following subjects make this a great course on TITANIUM—short, intensive, and of real value.

- **CURRENT STATUS**
  Sponge Production Techniques — Guarding against Contamination — Uses of Titanium in Airframes, Missiles, and Jet Engines — Economic Aspects
- **CASTING AND ALLOYING**
  Vacuum Melting—Effect of Alloying Elements—Present and Future Alloys
- **MECHANICAL METALLURGY**
  Strength — Ductility — Yield Properties — Effects of Temperature and Strain Rate
- **FUNDAMENTALS OF HEAT TREATMENT**
  Open Air Treatment—Vacuum Heat Treating—Embrittlement — Degassing — Annealing — Stress Relief — Equilibria — Kinetics — TTT Curves — Metallography
- **MACHINING AND GRINDING**
  Titanium's Affinity for Other Materials and Possible Machining Difficulties—How to Overcome Them—Machines and Tools Involved—Effects of Alloying on Machinability — Chem-milling
- **CORROSION RESISTANCE**
  Principles and Applications
- **WELDING**
  Welding Characteristics — Problems and Techniques
- **FABRICATION PROBLEMS**
  Hot and Cold Fabrication—Steps and Processes—Economic Factors
- **DESIGNING WITH TITANIUM**
  Uses of Formed Sheet — Forgings — Limitations of Castings — Honeycombed Structures — Powder Metallurgy Products

Titanium—a comer among metals—versatile—possessing many highly desirable qualities, yet costly and temperamental—presents unique opportunities and challenging problems. The high demand for titanium and its alloys in many forms is impressive—promises increased growth as production techniques improve and costs are reduced.

A CHALLENGE AND REWARD FOR MEN WHO KNOW

To meet the unique problems of titanium production and processing calls for a high degree of understanding of mechanical working, yield characteristics, and ductility, as well as the effects of alloying and heat treatment on the metal's behavior. Though many fabrication techniques may already be known, there's still much to learn. Something new is always ahead, so plan to attend the Titanium Conference and UPDATE YOUR THINKING!

THE LATEST AUTHORITATIVE INFORMATION QUICKLY AND AT LOW COST

To men who aspire to achieve in a new and promising field, the American Society for Metals, through its newly created Metals Engineering Institute, is conducting a five-day TITANIUM CONFERENCE in Los Angeles, March 25 through March 29, 1957. Top authorities will lecture, discuss, and instruct. It's an opportunity to get the latest information in minimum time—and at a cost of only $125.00 for the entire course (including daily lunches and study materials).

Since registration is necessarily limited, DON'T DELAY. Enroll now or send for full information AT ONCE. Mail in the accompanying coupon TODAY.

TITANIUM CONFERENCE March 25-29, 1957

Metals Engineering Institute, Dept. MP
7301 Euclid Ave.
Cleveland, Ohio

Gentlemen:

☐ Enroll me; $125.00 registration fee enclosed

☐ Send me more information

Name ______________________________

Company Affiliation ______________________________

Address ______________________________

City ____________________ State ____________

BRIDGEPORT BRASS

Bridgeport BRASS CO.

offers opportunities
for original research to an

X-RAY METALLURGIST

in the field of x-ray diffraction

Do You Have

- an M.S. in Metallurgy?
- two years exp. in x-ray diffraction?
- an operating knowledge of x-ray spectrometer and auxiliary equipment?
- an interest in identifying phases in non-ferrous metals and alloys such as copper, aluminum, uranium, titanium and zirconium?

Would You Like

- to work in an atmosphere of science and achievement . . . use latest technical equipment?
- to work with scientists who are leaders in their field?
- a liberal tuition set-up for continuing your professional studies?
- a battery of benefits for yourself and your family?

If You Do—Contact
BRIDGEPORT BRASS CO.
Mr. T. F. Burns
Salary Personnel Supr.
30 Grand St.
Bridgeport 2, Conn.

METALLURGISTS
WELDING ENGINEERS

Exceptional opportunities are now available at Armour Research Foundation. Our expanding and diversified research and development programs have created openings at all levels of experience for capable individuals specializing in the following:

Physical Metallurgy
Non-Ferrous Alloy Development
Applied Metallurgy
Extractive Metallurgy
Foundry
Welding and Brazing

These are permanent positions offering excellent salaries, optimum professional associations, and liberal benefits which include tuition free graduate study and generous relocation allowance.

Write to:

J. A. Metzger
ARMOUR RESEARCH FOUNDATION
of Illinois Institute of Technology
10 West 35th St.
Chicago 16, Illinois

DEVELOPMENT METALLURGISTS

For technical development of ferro-alloys, master alloys and special metals which are used in the production of:

1. Carbon steels and low alloy steels (openhearth and electric).
2. Stainless steels, toolsteels and high-temperature alloys.
3. Cast iron, ductile iron and malleable iron.
4. Aluminum alloys, copper alloys, titanium metals and other nonferrous fields.

To qualify for any of these positions, applicants should have an engineering degree, five or more years practical experience in production, processing and metallurgical development, and the ability to carry out constructive field assignments in pilot and production operations. Excellent opportunity with leading corporation. Confidential. Send complete resume, and state salary anticipated.

Box 3-155, Metals Review

SENIOR METALLURGISTS

PREFERABLY PH.D. OR M.S.

NUCLEAR REACTOR FUEL FABRICATION

Have you an extensive background in research and development of metallurgical processes in the area of fabrication of metallic structures? Or experience in Welding, Arc Melting, Cladding, and Powder Metallurgy?

If you have, positions of major importance in one of the most vital and interesting new areas of technological progress may be available to you.

Sylvania leadership has earned for it an international reputation as a pioneer in reactor fuel design and production. You stand at the forefront of this basic new technology when you join this company.

Please send complete resume in full confidence.
All inquiries will be answered within 2 weeks.

Write to: Mr. Richard E. Clarke, Atomic Energy Division

SYLVANIA **Box 59, Bayside, New York**
SYLVANIA ELECTRIC PRODUCTS INC.

QUALITY CONTROL ENGINEER
Young man with background in metallurgy and statistics for opening in newly created quality control program. Manufacturing processes include die casting, metal stampings and electroplating. Send resume to:
Personnel Department
Brown-Lipe-Chapin Division
General Motors Corporation
Syracuse, N. Y.

PROCESS METALLURGISTS

Exceptional opportunities available for engineers trained and interested in Pyrometallurgy, including all stages of smelting, melting, and refining of high-quality carbon, alloy and stainless steels. Chemical Engineering or Metallurgical degree required with a combination of both very desirable, plus four or more years of research experience.

Excellent salary and benefits are available with opportunities for creative development and professional advancement in this expanding Pittsburgh research laboratory of a leading manufacturer of specialty steels and alloys.

Send confidential resume and salary requirements to:

Mr. A. A. Marquer, Jr.

CRUCIBLE STEEL COMPANY OF AMERICA

P. O. BOX 88 PITTSBURGH 30, PA.

...A Notable Coincidence

The Second
World Metallurgical Congress

Entries Will Be Expected From All Over the World— —Display Your Best Work

RULES FOR ENTRANTS

Exhibitors do not need to be members of the American Society for Metals.

Work which has appeared in previous metallographic exhibits held by the American Society for Metals is unacceptable.

Photographic prints should be mounted on stiff cardboard; maximum dimensions 14 by 18 in. (35 by 45 cm.). Heavy, solid frames are unacceptable.

Entries should carry a label on the *face* of the mount giving:

Classification of entry.

Material, etchant, magnification.

Any special information as desired.

The name, company affiliation and postal address of the exhibitor should be placed on the back of the mount.

Entrants living outside the U. S. A. should send their micros by first-class letter mail endorsed "Photo for Exhibition—May be Opened for Customs Inspection".

Exhibits must be delivered before Oct. 15, 1957, either by prepaid express, registered parcel post or first-class letter mail, addressed:

Metallographic Exhibit
American Society for Metals
7301 Euclid Ave.
Cleveland 3, Ohio, U.S.A.

CLASSIFICATION OF MICROS

(*Optical and Electron*)

Class 1. Irons and steels.
Class 2. Stainless steels and heat resisting alloys.
Class 3. Aluminum, magnesium, beryllium, titanium and their alloys.
Class 4. Copper, nickel, zinc, lead and their alloys.
Class 5. Uranium, plutonium, thorium, zirconium and reactor fuel and control elements.
Class 6. Metals and alloys not otherwise classified.
Class 7. Series showing transitions or changes during processing.
Class 8. Welds and other joining methods.
Class 9. Surface coatings and surface phenomena.
Class 10. Results by unconventional techniques (other than electron micrographs).
Class 11. Slags, inclusions, refractories, cermets and aggregates.
Class 12. Color prints in any of the above classes. (No transparencies accepted.)

AWARDS AND OTHER INFORMATION

A committee of judges will be appointed by the Metal Congress management which will award a First Prize (a medal and blue ribbon) to the best in each classification. Honorable Mentions will also be awarded (with appropriate medals) to other photographs which, in the opinion of the judges, closely approach the winner in excellence. A Grand Prize, in the form of an engrossed certificate and a money award of $100, will also be awarded the exhibitor whose work is judged best in the show, and his exhibit shall become the property of the American Society for Metals for preservation and display in the Society's national headquarters in Cleveland.

All photographs may be retained by the Society for one year and placed in a traveling exhibit to the various Chapters. They will be returned to the owners in May 1958 if so desired.

The Twelfth
Metallographic Exhibit

Chicago, Illinois, November 2 to 8, 1957